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PURPOSIVE EVOLUTION

The religious spirit will be revived because it will be in harmony with men's unquestioned scientific beliefs and their ordinary day-by-day social activities. . . . While it is impossible to retain and recover by deliberate volition old sources of religion and art that have been discredited, it is possible to expedite the development of the vital sources of a religion and an art that are yet to be. . . . When philosophy shall have coöperated with the course of events and made clear and coherent the meaning of the daily detail, science and emotion will interpenetrate, practice and imagination will embrace. Poetry and religious feeling will be the unforced flowers of life. To further this articulation and revelation of the meanings of the current course of events is the task and problem of philosophy in days of transition. — JOHN DEWEY. From *Reconstruction in Philosophy*.

PURPOSIVE EVOLUTION

THE LINK BETWEEN SCIENCE AND RELIGION

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BY

EDMUND NOBLE

All Nature is but Art, unknown to thee;
All Chance, Direction which thou cans't not see.
—POPE.

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PREFACE

The issue of primal importance to-day in both science and philosophy, pressed in upon us by our new knowledge of both celestial and terrestrial wonders, is the nature of the process which, with whatever success or failure in grasping its method, we are accustomed to call evolution. Somehow or other a world order has emerged from that process, and there are multitudinous evidences of "design in nature." Are we to view the result as a mere outcome of chance, referring it to that haphazard clash of forces and materials which the physicist, the chemist and the astronomer have mainly in mind, or must we not look further afield for some principle of direction that has been regnant in both inorganic and organic from beginnings? The problem is vividly suggested by the gap which confronts us between objects which move only as they are pushed or pulled, "attracted" or "repelled," and objects which obviously have their powers of action within themselves. Is it to be taken for granted that life is a totally new manifestation — something appearing in the universe for the first time, unrelated to anything that preceded it, and to be explained, if at all, wholly from itself? Or must we not rather trace it back to pre-vital powers which belong to the cosmos at large and come only ultimately to function in living things? Are we to assert, as in the conventional view, that purposiveness can show itself only as an outcome of and as associated with consciousness, will and life, or is not purposiveness to be recognized in advance of these as the pre-condition, the very *sine qua non*,

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of evolution? Consider the evidence furnished by the organism itself. Human planning of means to ends, as shown in the making of tools and machines, is accomplished consciously and through awareness of the ways in which ends may be reached; yet within the human, as within the sub-human organism there are tools — tissues, organs and processes, all of them means to ends — with the fashioning of which consciousness and " planning aforethought " have had nothing whatever to do, and in the actual working of which they play no part. If consciousness is needed for all purposive activities why and how can such activities be carried on internally without consciousness? Is there here a total breach of continuity, or does not the purposiveness of both sets of activities, conscious and unconscious, indicate a common source of purposiveness from which both arise? Must we not regard this urge of the living body towards the realization of ends as originating in and derivatively connected with a vastly larger purposiveness, cosmic in its range, at first without psychic implications, yet culminating as purposively directed effort in man?

Questions like these call insistently for answers. Replies to each and all of them involve the "design problem," and to offer a solution of that problem, such as shall throw light on the method of evolution, the nature of life, the meaning of heredity and the scope of knowledge is the chief aim of this book. It is here held that purposiveness is a principle rooted in things, not a value at some point in time and place added to things — as the ways in which, through directed motion, ends are reached in both animate and inanimate, not as the consciousness of such ways. The vital activities of the organism, internal and relational, unconscious and conscious, are seen to derive from the self-maintaining activities of the universe; their purposive character is traced to a cosmos which is end-reaching before the coming of life and " intelligent " before the advent of consciousness. Natural selection, while retained as an eliminating factor, is relieved from the impossible task of giving rise to those variations which it only helps to conserve but cannot have any part in originating: by advance beyond the Darwinian theory to recognition of a purposive process in Nature we are enabled to pass from the "origin of species" to the origin of the organism, and from an obviously inevitable "survival of the fittest" to realization of why and how the fittest arrive. Finally, the symbolic conceptions of the Almighty which men in the mass find both beneficial and inspiring are widened out from the thought of a more or less anthropomorphic being, with powers fashioned after our own, to the thought of Deity as not limited by the realm to which the knowing faculty admits us, but stretching away beyond the entities that are knowable to inaccessible depths and heights — not as uni-potential, as acting only to procure the issue of the evolutionary process in man, but as multi-potential, super-organic, even super-cosmic, the source of all that is, yet also the source of other products or "properties" whereof we cannot conceive, of powers to which we are unable to give name, even more unlike energy, matter and life than these differ from consciousness, mind and knowledge.

In the interest of simplification the unit theory of the ether is adopted as subsuming and symbolizing such characters as may belong to the ether, just as the convenient formula of organic units is used to include the complex physico-chemical and electrical actions that go on within the living body. The whole conception is one into which the philosophical attitude enters less as a narrowly metaphysical method than as a means of using the larger yield of what is called truth for the revision, completion and enrichment of its partial deliverances.

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ist, the chapter on "The Principles of Nature Interpretation," and "Imitation and Originality"; from *The Open Court,* the chapters, "How Nature Was Ensouled," "Teleologies Old and New," "Parallels Between Religion and Science," and "Does 'Evolution' Explain?" A like acknowledgment is offered to the editors and publishers of *The Philosophical Review* for permission to use the chapter entitled "The Likening Process in Esthetics."

E. N.

October, 1926.

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ADUMBRATIONS

Nature is no more artist by chance than she is geometer by chance; her aesthetics are no more fortuitous than her industry. It is because there is an industry of Nature, a geometry and aesthetic of Nature, that man is capable of industry, of geometry, of aesthetics. Nature is all that we are, and all that we are is derived from Nature. The creative genius which the artist feels in himself is the revelation and the symbol of the creative genius of Nature. — PAUL JANET.

So far as law is concerned, we observe that the evolution of life forms is like that of the stars; their origin and evolution as revealed through palaeontology go to prove that Aristotle was essentially right when he said that "nature produces those things which, being continually moved by a certain principle contained in themselves, arrive at a certain end." What this internal moving principle is remains to be discovered. — HENRY FAIRFIELD OSBORN.

We feel compelled to recognize the persistence of some originative impulse within the organism, which expresses itself in variation and in mutation, and in all kinds of creative effort and endeavor. — PATRICK GEDDES and J. ARTHUR THOMSON.

Mutations produce functionally perfect organs or modifications of organs; if they did not do so it would be impossible to suppose that they have played any considerable part in evolution. They demand, therefore, for their explanation, some formative directive principle. — WILLIAM McDOUGALL.

Is there not, perhaps, an unknown force underlying these numerous developmental series as the true motor power — a developmental force urging species to vary in certain directions, and calling into existence the chief types and sub-types of the animal and vegetable world? — AUGUST WEISMANN.

Selection is a true theory. . . . It establishes that organisms struggle against each other — it does not give any account of the cause which makes them struggle. . . . Selection is only a part of the problem. We must look further afield. . . . Beneath the mathematico-chemico-physical mechanism which governs us we feel hovering vaguely something of the nature of a directing idea — the expression is that of Claude Bernard. — CHARLES RICHET.

The discovery of any cause or form of control which would direct variation in certain more or less definite directions would help very much in solving the great problem of the cause and control of evolution. — VERNON KELLOGG.

It may be that, by and by, philosophers will discover some higher laws of which the facts of life are particular cases; very possibly they will find out some bond between physico-chemical phenomena on the one hand and vital phenomena on the other. — THOMAS HENRY HUXLEY.

The palm will be won by him who is fortunate enough to trace the formative forces of the animal body to the universal or life-tending forces of the universe. — CARL ERNST VON BAER.

PART I

THE UNIVERSE AS HUMANIZED

CHAPTER I

THE THOUGHT CRISIS IN RELIGION AND SCIENCE

It needs only scant acquaintance with the yield of modern thought to convince us that we have come upon a period of overturn in Nature knowledge, and that for the higher exercise of human reason a moment of crisis has been reached. Never was there a time when man had so mastered the world as to-day, yet after centuries of Nature study, rich in the spoils of science, the great problems of the universe and of life still confront us unsolved. Our perceptions continue to qualify us for the adjustments needed in daily existence and essential to what we call progress; but when we transcend these in search of some all-inclusive view which shall rationalize us and them, we enter a realm where theories clash, controversy is at its noisiest, and though assertions multiply, nothing is really settled. And it is in this dim land which only speculation illuminates that the intellect, which should come to our support, turns even as we use it into an instrument to confirm us in our uncertainty, until we realize that, by successive denials of sense and progressive refinements of thought, man has lost the grip on things which he had when he knew them less and believed in them more.

Especially is this conclusion forced upon us by the new attitude in religion. Faith drew its materials in the past from sense, was potent through feeling, and always had a concrete object. Near to mind and heart came:

> The power, the beauty and the majesty
> That had their haunts in dale or piny mountain,
> Or forest by slow stream, or pebbly spring,
> Or chasms and wat'ry depths.

Real for the race were the Zeuses with their ambrosial locks, the Odins enthroned, and the Peruns who thundered. Even more vividly did the deity of monotheism look down upon the sons of earth: somewhere beyond the sun or behind the stars humanity could figure to itself a being in its own image to whom sacrifices might be offered, and to whom prayers could ascend. But when the restless intellect, bent on unifying and deanthropomorphizing, broke up this sublime conception into a spiritual essence, to be scattered as a sort of psychic dust through the cosmos, new and strange ways of presenting the divine had to be contrived. We could still formally envisage the diffusion as deity, but our conception of it no longer welled up in vivid outline for the imagination — it had to be artificially elaborated by the mind. The coherent object of worship, once potent in race thought, has thus been exchanged for a synthesis of propositions which, however we may entertain it, does not really possess us. Do what we will, we cannot weave these chopped-up units of logical analysis and definition into a personality. The something we are expected to fear, the something we are expected to love, has become an abstraction. And so the night of metaphysics settles down on the bright forms that once lit up the world of faith. The day in which our ancestors revelled closes in gloom, and we awaken from our dream of "immanence," if at all, only to find that it is Nature herself, not a ghostly essence within Nature, which is "closer to us than breathing and nearer than hands and feet."

It is significant of our age that a similar change is taking place in science, and that what we have laboriously acquired for the rationality of our Nature knowledge is in danger of being lost for its realism. We are here reminded in the physical field of the definiteness which was once ours in religious conceptions. The mechanical account of the universe gave us concrete material buttressed in the yield of the senses, and therefore in harmony with everyday human experiences. The terms were ether, matter, energy kinetic and potential; phenomena physico-chemical, electro-magnetic; everywhere action and interaction in a universe whose changing configurations, in the minute and in the large, submitted themselves to exact mathematical description. To the laws framed for combining and summing up these materials no exceptions were admitted; in the changes recorded or predicted no mysterious essences had to be taken note of and no teleology recognized. From the data thus laid before us by the physicists, with everything like will, consciousness, caprice eliminated, we gained a vivid and intelligible idea of the world. And in the interest of unity the same definiteness was won for us in the realm of things organic. By ignoring the teleology of the vital processes it has been possible to concretize life as the outcome of the physico-chemical properties, of pushes and pulls, of attractions and repulsions. The organism is a compound of inorganic substances, the bulk of it water; its activities show close analogues with inorganic processes; the physics of the muscles plainly arise out of the chemistry of the cell. In a word, there is nothing in vital phenomena to remove the living system from the category of natural objects, nor is there any reason why the daring experimenter should not be able to build up life from inorganic matter in the laboratory. In this way, by progressive assimilations of the vital to the mechanical, the cast-iron universe of Descartes has been pieced on to the cast-iron organism of Lamettrie, D'Holbach, and Büchner. Modern research into the physico-chemistry of life merely expands this triumphant assertion of the mechanical continuity of nature. The organism as vital, purposive, teleological, continues to baffle us; the organism as a machine gives us a realizable image and brings life home to the dullest comprehension.

But there has been a revolt from this naïve view of vital phenomena, as there was a revolt from the concrete anthropomorphisms of religion. The vitalist, neo-vitalist, or psychist — call him what we may — insists that there is something more in the universe than mechanics, and something more in the organism than physico-chemical processes. It is held, in the phrase of Lord Kelvin, that "there is a mysterious, spiritual influence abroad in the world," "an influence distinguishable from physical, dynamical, electric forces"; and Sir Oliver Lodge, another physicist, writes of "a universe not dominated by physics and chemistry, but utilizing the interactions of matter for its own purposes," so that "many a thinker, brooding over the phenomena of Nature, has felt that they represent the thoughts of a dominating, unknown Mind partially incarnate in it all." Ideas such as these naturally culminate in panpsychism, written either small or large — as an endowment of all material ultimates with elementary powers of sentience and will, or as a cosmic consciousness coextensive with things, at once their intelligence and driving power. The subjective interpretation here applied at large comes also to be utilized for the elucidation of vital phenomena, which we are invited to envisage, either as the outcome, or as under the control of "psychic forces." But as the supporting verbal propositions accumulate, the vivid images which mechanism gave us of the universe and of life fade out, and we find ourselves again gathered around with darkness. Under the psychic interpretation of it

Nature becomes, as in the Emersonian formula, " the immense shadow cast by man."

Latest of all in modern speculations is a mathematical doctrine which threatens the fundamentals of thought in both science and religion. On the ground of a reported discovery that " light " gravitates — that it may be matter in motion, and not a disturbance propagated in the universal " medium " — we are asked to see in that event confirmation of a principle of " relativity " which derelates things by making it possible to view them as self-sourced rather than as system-sourced. The ether, so long regarded as the ground of reality, is now ignored, or perhaps expected to abdicate in favor of a vast nothingness conceived of as occupied here and there by somethingnesses — electrons, atoms, molecules, and the aggregations of these we call suns and planets — each of them going its own way and active in its own right. In the older outlook the power which fashioned them into appearing could at least be credited with the marshalling of them as its function; in the new hypothesis matter need not have originated, is under no necessity of being sustained, and owes no allegiance to the nature or action of any larger system than its own. The common process visible in the combinations of the chemist and in the fashioning of worlds, in the growth of a blade of grass and in the workings of the human mind, is no more to be explained by a common impulsion, or to be referred to a common source. The unity which we meant by " universe " disappears; the order which we mean by " cosmos " passes as a tale that is told. In the vast vacuity which " relativity " offers as a mere containing receptacle for things, the scientific believer will lose his grip on efficient causes and the religious believer will search for Deity in vain. For such must ultimately be the result of an attitude which implies that successful theorizing may be carried on in one department of Nature knowledge without regard to the rest, and that if the demands of logic can only be satisfied we are entitled to make the universe what we will.

Meanwhile the older situation asserts its rights, and there the age-long conflict between religion and science emerges complicated by a conflict within them. In both fields the conceptions of the race, most vital when they are anthropomorphic, struggle to assert themselves against the refinements of the metaphysicians. On the one hand, the concrete idea of Deity as a colossal man is opposed by the vague and unintelligible idea of Deity as a colossal mind; on the other, the mechanical account of things clashes with the psychical interpretation of Nature. More and more the advanced thought of the age is being lured towards the primitive beliefs which projected consciousness, will and purpose into the universe. The issues once squarely drawn between science and religion have begun to overlap, and disintegration of them is threatened, if not already in sight. Thus far we have had to choose between a myopic materialism which sees nothing but mechanics in the universe and a conceited spiritualism that insists on fashioning the total frame of things in its own image. We are now to consider whether there is not some larger and worthier view of creative power than that which sums up the cosmos in a spiritual formula, or subjects it to a psychical interpretation, on the ground of a warrant yielded only by the restricted area of life and the narrowly delimited experiences of man. Facing this possibility, religion and science, divided within themselves as well as against each other, both stand at the parting of the ways. With them we are to decide whether we shall think grandly or meanly of the Almighty; we are also to determine how long the solution found for the Nature problem by men in their infancy shall continue to rule in modern thought. It will help us towards the larger view if we try to realize how the anthropomorphic explanation was originally reached, and through what influences, primordially exerted, the dead mind of the past—more potently than any "dead hand"—still succeeds, after ages of scientific emancipation, in imposing its thrall upon the living, alert and well-informed mind of to-day.

CHAPTER II

HOW NATURE WAS ENSOULED

The life lived by primeval man millions of years, it may be, before the beginnings of recorded history, was a life of contact with Nature the closeness of which has no parallel in modern times, even among savages. Our ancestor had to fight his own individual battle, and had to fight it in the open. During periods geological by their length his struggle kept him continually on the move — everywhere facing air and sky, everywhere bathed in shine or shower, everywhere drawing in from his environment that knowledge of Nature at first hand which was to come to his successors mainly through books or by means of personal instruction. His earliest acquaintance with this outer world was probably gained in the forest, since it must have been in an arboreal surrounding that, forsaking the quadrupedal for the bipedal attitude, he made his first acquisitions in the realm of human speech. Here it was that, only just cunning enough for the spoken word, he was glad to mutter his first incantation, half prayer, half apology, to the beast he had been compelled to slay for food; here, too, that he must have emerged from his first successful encounter with a sense of the embodied potencies of animal life of which the modern sportsman feels nothing.

And it was in or near this leafy retreat, which now held off the torrential rain-burst, or now shielded him from the midday heats, that many species of animals competed with him, directly or indirectly, for the opportunities of subsistence. Athwart his pathway glided the snake, incomprehensible in its powers of motion and disappearance; above him, even more unintelligibly, soared the bird, resting without support or moving without effort — able to make itself invisible before his very eyes behind leagues and leagues of transparent distance; around him were the lithe, bounding animals of prey, here the striped forest-prowler or the leaping, cat-like lyers-in-wait, there the broad-browed graminivora and the horned runners with the split hoof — all fitted to stimulate his imagination and test his skill in cunning or combat. Roamer in the forest, he was also hunter along the river-bank; as fisherman, he awoke to the still stranger powers of the water-world, with its tidal irregularities as mysterious as its sudden inundations, its sources at heights which the vision placed near the meeting of cloud and mountain-top, its wondrous life concealed in sunken rock-palaces and submerged caves. Nor did his mind find less incitement to activity in the travail which made him alternately an agriculturist and a raiser of herds, or at a later stage gave both these interests into his keeping. In the open field, beneath an open sky, he could store up as daily lessons the sights and sounds of the most primitive meteorology man has ever known. And though the vault above might feed his sense of wonder as night succeeded to day, he had around him a yet greater mystery — the seasonal return of plant life, the waxing and ripening of the seed, the gift by earth and sun and air of his daily bread.

Perhaps the grandest of all the objects that met his gaze as more and more he gained opportunities for contemplating it was the earth itself — the solid mass which, extending beneath his feet as far as eye could reach, seemed, according to his elevation, now like a plain of enormous thickness, or again like the same disk sloping from the horizon into a concave beneath him, yet ever cupped over by the same inverted hollow, the same melting, evasive, unfathomable depths. How the massiveness of our planet must have impressed him; early enough in his goings to and fro must he have felt the mightiness of its strength, not to be tipped aside by all the weight of the cloud-soaring mountains — the firmness of its foundations, not to be shaken by all the length of the outstretched sea or the raging thereof! Nor was it any the less mighty because man had as yet created nothing of his own to distract from the wonder of the Nature environment — had raised no temples, obelisks, coliseums, aqueducts or amphitheaters to compete with it in suggestiveness or in splendor. The far-extending city did not yet exist even in dreams; the only known architecture exhausted itself in those simple lines and curves that went to the making of the rudest domiciles ever contrived. For then our ancestor had his home in the forest tops, or he wove it aground with the branches of some fallen tree; crept into some crevice left by the subsiding of rocks once upheaved; sought on the rude, pile-supported platform the protection of surrounding waters; or appropriated inshore the cave deserted by some wild animal. None of these could seem other than insignificant and contemptible when contrasted with the massive, the tremendous Nature that lay everywhere about him — world of crag and valley, of lake, island and stream — an expanse of far-extending territories which forest might darken or mountain range wall in and divide, but which must none the less have acted on his imagination with a vividness and power of which our own poetry-aided feeling of to-day gives us no more than a suggestion. Is it strange that with the sense of its features in all their luxurious ensemble strong upon him — features of breadth and distance, of height and depth, of fixity and movement, of color and form — our forefathers should have given ceremonial expression to their feelings in earth worship, and should have made the bridal of the earth and sky the subject of so many of their myths?

Not less potent in their influence upon the primeval mind were the phenomena of the heavens — the realm into which the bird disappeared, the deeps from which the hissing meteor came forth, the broad gateway through which the dawn made its way. To such a mind the daily return of the sun must have been awe-inspiring beyond anything now conceivable by moderns for whom sunrise, which they rarely witness, has shrunk to a tedious commonplace. Sometimes bringing death as well as life in its wake, the devastator of the scorched plain, as well as giver of growth to the sown field — the orb of day called forth the adoration of the agriculturist as well as of the sun-worshiper, and by common mortals everywhere must have been looked for with an eagerness of which our own science-protected humanity knows nothing. If the return of light is striking enough even when it floods the arctic plain after months of absence, what must it have been to primitive man in latitudes where the transition from dark to light is accomplished in a few minutes, and where the whole busy life of wood, stream and plain bursts anew into activity ere one can realize that it is day? And if into the sun, thus endowed with power over Nature, primitive man could not fail to read the characters of will and personality, as of a Nature deity daily enthroned, the moon herself, inexplicably growing and fading — her sky march all the more impressive because intermitted — could not escape a like personification. Nor were the stars wanting in a suggestiveness all their own as, night after night, year after year, the bright luminaries succeeded each other along the same celestial track, sometimes shrunk to points of nebulous star-dust, elsewhere expanded into heaven-circling highways — most lustrous of all when touched into planetary splendor, here with a blaze in the night-sky, there with a silver spangle on the brow of morning. That all this mysterious show — of sun, moon, planet and star — should once every twenty-four hours pass away from sight, and only by some sub-celestial necromancy hidden below the earth's rim, should finally reappear again, must have been the wonder of wonders.

There was indeed enough in the silent, motionless, unchanging aspect of the environment to impress Nature deeply, indelibly upon the fresh feelings of primitive man: to this aspect of the world, with its suggestions of power, magnitude, immensity, endlessness, our ancestor could have accommodated himself without difficulty. Yet Nature was not rounded off in surfaces, however extensive, or in mere objects, however numerous. Under scrutiny, its steadily burning lights became dissolving patterns that might be said to fashion men's nocturnal experiences each night anew; its solid earth, in the stress of life upon and motion over it, became a shifting floor the condition of sure foothold in which varied from day to day. Not the quiescent, the immovable, but the changing elements it was that made Nature terrible; for it was a Nature ebbing and flowing, seething and bubbling, rising and falling, swelling and subsiding — a Nature ready to rise and overwhelm, prepared to fall and engulf, yet withal a Nature in the deadliest sense uncertain and unknowable. Think of darkness in such an age, and of the terror which it brought! If we would realize its fear-burdened night, we have only to picture our rude ancestor with bone-headed spear defending his usurped retreat from the cave bear, or with fire-girdling bivouac holding off, for a few brief hours of slumber, the whole forest of mysterious sounds hurled at him in mock or in menace. If we would know on what vicarious pains our own safety in life is founded, or appreciate at its true worth the care-void complacency with which we go about our daily tasks, and after sunset in our street-protected cities build up again from undisturbed sleep the strength needed for the morrow, we must recall the thorny ways through which, with torn limbs and bleeding feet, amid hardships and perils beyond counting, primitive man — gibbered at by everything anatomically and intellectually beneath him — toiled up the first steps of the ascent to civilization, hewing a safer pathway in the obdurate rock of circumstance for those who were to come after.

The terror was by day as well as by night, belonged to all seasons, and far outlasted the beginnings of individual human life. Spirits disputed the way to its coming throughout the period preceding childbirth, and birth itself, ceremonially aided, did but introduce man to incantation on a wider scale. To avert the omen and ward off the evil became his never-ending solicitude. What care he took in the selection of his cave or hut, with a spell for its every branch and beam! How guarded from ghostly maleficence were his crops, his cattle, his implements! His very days, in an age swarming with demons, were made "lucky" or "unlucky." Not an object passed in his outgoings, not a happening in his environment, which might not, through the subtle influence of analogy, doing duty for the knowledge of cause, announce to him the displeasure of one deity, or become the deadly, self-executing vengeance of another. So surrounded was our ancestor with invisible beings awaiting the opportunity to injure or destroy, that he could not carelessly throw away the tuft of hair from his head, or the nail-paring from his finger, lest these objects should immediately be directed against him as instruments of a malevolent will. His name could not be pronounced save with precautions taken to safeguard him from evil; the rude drawing of him on slate, sand or wax — so absolutely was he at the mercy of his fears — might very well be used in a persecution culminating in his death. The magician was indeed his enemy; yet the most terrible of the sorcerers who beset him was his own mind, the subtle linkings and enchainments of which, aided by the psychological demand for a theory of cause, so involved him in the phenomena of his daily object-world that any unusual incident — any chance association — a supposed or real likeness — the coincidence of some personal experience with some unusual natural event — sufficed for the sorcery of which he was himself largely the originator. The whole story of savage magic and modern witchcraft yields us but a pale reflex of the conditions under which early man successfully asserted his primacy in the animal world not only against living competitors, but also against the spirits and demons, the ghosts and deities who, conjured into existence by his own imagination, contested every foot of his way upwards.

Primitive man failed, not so much in knowledge of Nature changes as in power to interpret them. Within the great commonplace uniformities which brought day and night, which yielded the phases of the circling moon and presided over the return of familiar constellations, there were thousands of occurrences as unforeseen and unpredictable as is the cloud-pattern of any midday sky which, with its streaks of white, its patches of gray, its blue-bounded hillocks of vapor, its far-extended and threatening sheets of gloom, shifts and moves and flows above us like a panorama. From the realm of phenomena whose incessant stream was even more tangled and causally obscure than are many meteorological phenomena for us to-day — out of the maze of vicissitude whose separate elements traversed each other in countless complexities of intersection — primitive man sought, vaguely and only half consciously, that organized sense of definite processes sure to be repeated whenever the conditions recurred, which we now called acquaintance with natural law. From the ghostly patter of the wind-driven leaf over the surface of the snow plain to the writhing of the many-armed forest under the lash of the storm; from the soft flame of the will-o'-the-wisp to the meteor shower threatening with destruction the whole works and race of man; from the simplest changes of plant life to the phenomena everywhere yielded by man himself — the swoon, the long fast, the awe-inspiring delirium, the mysterious death — Nature's crowded events beat incessantly against the human mind, yet found in that mind no explanatory principle other than the subjective solution dictated from within.

Helpless in the presence of phenomena, man needed an intellectual deliverance, and this could come only through an adequate knowledge of cause. As yet, his mind was unfitted for its discovery. Impressed overwhelmingly with the superficial differences of objects, our ancestor failed to recognize their profounder likenesses, and therefore could not bring into existence the deeper classifications that were needed. Living largely in the feelings of the moment, with only an elementary degree of the power to compare and relate, he was at the mercy of the sense images of objects, and of the disparate glimpses of his environment which they yielded. His view of nature resembled that of one who, eager to see the complete surface of a planet in full sunlight, should be allowed to make out no more than the illuminated peaks which it presented to him at sunrise. And it was because primitive man failed to realize those deeper bonds of connection which stretched beneath and connected the luminous points of his sense system — failed to recognize the profounder likenesses, the fundamental causal characters of things, — the great gaps of darkness which the later science was at last to flood with light — that he failed in all save the introspective interpretation of phenomena.

The time for confidence in Nature had not yet come, and man, distrustful of his surroundings, fearful of his ignorance, turned to the one object which he knew better than any other, turned to the one process with which long experience had made him familiar — turned to himself and sought in his own body, in his own feelings and thought, the explanations which Nature had concealed from him. Lacking adequate knowledge of cause, he projected consciousness and will into aspects of the inorganic world, read a spiritual nature into the inanimate things which impressed him most, and by magnification of his own wishes and fears invested objects in his environment with magical powers. The process was only crudely symbolic, yet it helped man, however inadequately, to adapt himself in the interests of self-maintenance to the perplexing vicissitudes among which his life was cast. And it was the vast period during which this subjective view of Nature swayed the human mind in the formative ages of race life which accounts, as nothing else can, for the strength with which, if in refined forms, it still dominates the thought of the world.

CHAPTER III

MAN-LIKENING AND MIND-LIKENING

MAN'S resort to himself for the means of interpreting the world around him arose out of the very nature of the knowing process, since knowledge of things is never primarily of what they are, but rather of what they are like. We cognize an object by referring it to the class of objects which it most resembles, and it is the things most familiar to us that we thus use for cognition of objects that have not yet become part of our mental possessions. The earliest and deepest class impressions are necessarily those which arise out of man's knowledge of himself — of his body and the parts thereof, of his corporeal activities, of his feelings and thoughts; next, of the bodies of other men and of their movements; then, of the social and political conditions in which at any given period he may happen to be living; finally, in a decreasing order of vividness, of the animate and inanimate objects less nearly related to his life. It is these classes which, by virtue of their priority and strength, naturally acquire dominating influence over all later mental acquirements. It is to them that the mind refers the impressions gained from the more remote inorganic world. They form, in a word, the groundwork of our interpretation of nature.

The effort to explain the external world in terms of ourselves is widely seen in language. Note the naming of inanimate things after parts of the body, as in the case of "door," called the "eye of the house" by the natives of Banks' Island; of "son-tree," the term applied by the

Siamese to fruit; of the Malay's use of the noun "child" for "lock"; of "house-belly," the African Mandingo's equivalent for "in the house"; and of "hair," often used for "leaf" or "feather" in many Melanesian languages. In modern forms of speech the same process is suggested by such expressions as the head of a bridge, the mouth of a river, the eye of a needle, the trunk and arms of a tree, the nose of a promontory, the ears of a book, the fingers of a clock, the legs of a table, the veins of marble, the foot of a mountain. The activities of the human body are also thus transferred, for we speak of things as standing, sitting or lying, as rising, falling, running or climbing, and use such expressions as "striking clock," "dancing light," "sleeping lake," "yawning precipice," "laughing skies," and "babbling brooks." The sense of hearing is utilized in *taube Nuss* ("with nothing in the shell") and *taube Kohlen* ("those which have burned out"); so the defect of blindness is objectified in the *coecum vallum* of Roman speech, in *ciego,* said in Spanish of cheese that "has no eyes," and in the *blinder Schuss* of the Germans. It is not only in the genders of words that inanimate objects are called alive or dead: we have the expressions *caput mortuum* of chemistry, *eau vive,* "dead water" (turn of the tide), *tote Farbe, lebhafte Farbe, vivus lapis* (firestone), "quicksand," "quicksilver," "dead weight," "dead of night," "dead level," and *totes Kapital.* Nor has this reading of vitality into inorganic objects, common enough among savages, disappeared from the thought of civilized races. Stanley Hall's inquiries showed that out of forty-eight children just attaining school age, twenty believed the moon and stars to be alive, fifteen thought a doll and sixteen thought flowers would suffer pain if burned. One pupil described the crescent moon as "half-buttoned into the sky"; the spluttering of coals in a fire was called "barking" by a girl four and a half years old. Miss

Ingelow says that when over two years of age, and for about a year after, she had the habit of attributing intelligence not only to all living creatures, but even to stones and manufactured articles.

Parts of the body are also relied on for numerical aspects of the environment. Thus the Chinese use for "two" the syllables *ny* and *ceul,* which originally meant "ears," while the Hottentots employed the word "hand" in the same sense. In numerous languages the term for "hand" signifies "five," "two hands" meaning "ten," and "man" (two hands and two feet) "twenty." The Gallas word for "half" has been traced to the word *chaba,* "to break," and is the equivalent of our own word "fraction." The Letts, owing to their habit of throwing fish three at a time, employ the word *mettens,* "a throw," in the sense of three; among the same people flounders are tied in lots of thirty, whence has arisen the practice of designating thirty by the word *kahlis,* meaning "cord." The finger, the thumb, the hand, palm, forearm, foot — the extended arms as in the ancient *orgya,* and the extended legs as in the modern "yard" — have all played a part in determining the standard measures of civilized peoples. To the same class belong the γυη, the extent of field that could be worked by the laborer in one day; the *stade,* the distance which a good runner could traverse without stopping to take rest; and various measures of time, such as the old division of the day based on the length of a man's shadow.

How deeply man reads into nature his knowledge of familiar objects and phenomena is shown by his names for seasons, many of them based on the fall of the leaves, the reappearance of particular stars, or the periodical inundations on which he depended for food. The most primitive method in chronology is that which associated particular lunations with vicissitudes of weather, with seasonal aspects of vegetation, and with the constantly changing sights and sounds of the animal world. In the calendar of the Crees, for example, we find such designations as "duck-month," "frog-moon," "leaf-moon," "berries-ripe month," "buffalo-rutting moon," "leaves-entirely-changed moon," "fish-catching-moon," "ice-thawing-moon," "eagles-seen-moon." So in the calendars of Central America and Mexico, the months are named variously after the arrival of birds, the blossoming of flowers, the blowing of winds, the return of mosquitoes, and the appearances of fishes. The Greeks constantly used the movements of birds to mark the seasons; the arrival of the swallow and kite were thus noted. Hesiod tells us how the cry of the crane signaled the departure of winter, while the setting of the Pleiades called the ploughman to his toil in the field. The Incas knew Venus as "the hairy" because of the brightness of her rays, just as the Peruvians named her "the eight-hour torch," or the "twilight lamp," from the time of her shining. One at least of the three portions into which the Greeks divided their night received its name from the social custom of lighting the lamps at dusk. For all races the passing of the sun made night a time of danger, and man did his best to lessen the mystery of the heavens by filling their obscure depths with the figures of animals and heroes, by likening their shining lines of cosmic cloud to roads or highways for the march of beings terrestrial and celestial. Thus, for the speakers of Sanskrit, the Milky Way was the "Path of the Gods"; the Lithuanians dubbed it the "Bird Road"; in Low German it is the "Way of Cows"; the Cymris associated it with the course of the wind; for Scandinavians it was the "Road of Winter"; the Persians viewed it as the route along which the straw-carrier drew his burden; to this day the Winnebagoes call it the "Way of the Chiefs." Fijians and Tahitians alike not only imagine the "world-ocean" to be, like their own environment, full of islands;

they picture their deities as fond of building ships and making daring voyages. The people of New Guinea, being much afloat, see in several of the constellations the "Boat with its Outrigger." Among the Polynesians the shape of "Tamareti's Canoe" is given to Orion, the Southern Cross, and adjacent stars, while the Pleiades are known among them as the "Bowsprit of the Canoe."

Nor have we moderns outgrown the need of naming our environment in terms of concrete and familiar human experiences. It is not merely that we keep our genders, and continue to name objects and phenomena in ways inherited from the past; nor yet merely that poetry pleases us most when it depicts nature as most alive. There are spiritualists who, in theories of "the other world," project into it the human environment and see in its furnishings not only animals and vegetation, houses and public buildings, but even universities for education and lecture halls for audiences in search of knowledge. Science itself employs phrases dictated by the activities of man and of the societies which he forms. Such words as "attraction," "resistance," "atom," "current," all display their anthropomorphic origin. The human element of the term "inertia" may be more or less veiled by unfamiliar Latin, yet it is plainly recovered for us in the German form of the word. We still speak of "affinity" in chemical reactions, and transfer the term "law" from the realm of jurisprudence to the domain of natural processes. A large aspect of biology is concerned with the origin and development of what are called "intelligent adaptations," yet no biologist assumes that the consciousness of either plant or animal is at work in their production. The world of science has moved on since the Bridgewater Treatises, but we continue, in forms grosser or more refined, to project human "intelligence" into the heavens.

From the beginning, then, man has been at work endeavoring to explain Nature in terms of his own body, in terms of his familiar experiences, and in terms of the thought founded upon these — trying to come into relation with the external power which affects his existence for good or for evil by assimilating that power to himself, by making it over into his own likeness, and therefore by applying his human measure to the whole cosmos. How did the process begin? The earliest organic characters projected into the environment could not well have been other than that of motion. That by the higher mammals, at any rate, moving things, even when inorganic, are generally regarded as alive, is a view rendered probable by a large body of evidence. With the appearance of man, a new character was added to that of vitality. By contemplating the phenomena of his subjective life, and observing analogous phenomena in his fellow-beings — through the consideration of dreams, swoons, even death itself — our ancestor discovered that the living creature was not only alive, but also animated. At first the conception of vitality was one with the conception of bodily activity; at last man learned to differentiate the movements of the body from an inner essence to which he believed them to be due — learned, in a word, to distinguish between the corporeal existence and the soul. And having thus separated psychical from physical attributes, he would naturally transfer this distinction to the world of objects. The beneficent influences of nature, so necessary to his life, he now invested with the good purposes of the better nature within him; in the maleficent forces of the cosmos he read the malignant will of his own angry passions.

But it is not as mere phenomena that Nature powers thus ensouled and personalized can be thought about. The primitive human mind carried on its mental processes largely with the aid of images — recovered impressions of something seen, heard, felt or tasted — and was yet far off from the scientific stage of thought which superposes abstract concepts upon the simpler elements of sense impression. Personal Nature powers had to be realized concretely, if at all, and man found the means of assimilation ready at hand in the animal and human shapes already familiar to him. Discovering some likeness between a Nature force and some animal, he associated the two, and recalled the image of the animal when he wished to think of the abstract Nature power. Or, associating some departed ancestor, relative, hero, or king with the Nature force — an association which would be strengthened by belief in the survival of the soul after death — he gradually confounded the disembodied human power with the soul of the Nature power, and used the one as the less difficult means of mentally realizing the other. But whatever the process, animal shapes were needed to bring the ensouled Nature forces within the range of primitive thought; and there is scarcely a race in existence to-day without traces of this original zoömorphism. Note the mythological use of the bird by the Japanese, of the coyote and rabbit among the north American Indians, the steinbok by the Bushmen, the alligator by the ancient Egyptians, the modern Africans and Filipinos; the crocodile among the natives of Madagascar; the shark among the Malays, the elephant in various tropical countries, and the fish by the islanders of the South Pacific. The same clothing of the abstract, remote and invisible with the forms of objects near at hand and familiar, is seen in the Egyptian pantheon, where the deity is half animal, and where on human shoulders rest the heads of lion, ape, giraffe, crocodile, ram, serpent, ibis, jackal and hawk. Nor does the method of projection differ when we come to the winged colossi of Assyrian halls, the cherubim of the Hebrews, the horse-headed kinnaras of the Hindu, the centaur and minotaur of the Greek. And there are here plain tokens of an advance from pure zoömorphism, or animal-likening, towards anthropomorphism, or man-likening. For while in most races the earliest shapes thus utilized were those of the lower animals, the final form for all races was that of man himself.

Two aspects are thus recognizable in human interpretations of the environment — on the one hand an aspect crudely causal, since it seeks the source of the power put forth by objects and natural processes; on the other, an aspect which is obviously formal, its main significance being that it condenses groups of qualities or properties into a single mental sign. In theory man traced the activities of the inorganic world first to vitality, finally to personality; but he could make that theory available for his thought processes only by clothing the Nature powers in animal or human shapes. Not less important was his passage from the idea of a multiplicity of Nature forces to that of their unity. As at the beginning man reads vitality into separate objects and powers, without any thought of their underlying oneness, so he regards as discrete, unconnected, objectively unrelated, the multifarious souls with which, in his thought, these various forces of environment have come to be animated. Then in course of time, by an inner necessity of intellectual growth, relations come to be perceived between the Nature powers, likenesses are recognized between the functions of spirits and deities — between the potencies put forth and the results achieved. Hence that process of coalescence which, to describe it in the briefest way, first merges a large number of spirit-evolved gods into a smaller number of relatively independent deities, forms these into pantheons of gods each subordinated to a superior, and finally unites all beings regarded as divine in the single, all-comprehending, omniscient and omnipotent Deity of monotheism.

It is perhaps in the anthropomorphic stage that the subjective method of interpreting Nature finds its most concrete illustrations. The worshiped deities may be many or few, numberless as the Nature forces, polytheistic as among the Greeks and Romans, or one as in the monotheism of the Semite. Man likens them to himself, attributes to them not only his bodily shape, but also his failings and virtues, making his pantheon resemble not only the social order, but also the political system under which he happens to be living. The spirit world of a horde of savages could only reflect the ununified life of the nomads whose imagination it satisfied. But as the household made its appearance, as a definite social structure arose, and the straggling tribes began to be united into nations, the gods themselves took on the characters of a parallel transformation. The divine selfishness — the *remota ab nostris rebus* — long ago satirized by the poet Lucretius, obviously correlated with the attitude of man towards man, just as naturally gave place, with the growth of the social sympathies, to the thought of that more active concern in human affairs which is so prominent in the later phases of monotheism. The original indifference of Deity towards ethical issues — a widespread feature of the earlier religious conceptions — could not but pass away with the moral stagnation of the ancient communities out of which it had arisen. So the comparatively new thought of a God definitely identified in his aims and activities with the cause of moral reform is no less obviously a result of the new attitude of man himself towards problems of social amelioration; while the persistence with which in human thought morals remain associated with religion sufficiently illustrates the extent to which man's view of each has been determined by the knowledge and experiences which underlie both. Observe also, with the manifest relation in which our human thought regarding mind and body has always stood towards the conceptions of a world-soul, the dependence of man's view of the relation of God to the world upon his knowledge of his own planet and of its place in the universe. As long as our ancestor held the old geocentric theory of the cosmos — regarded the heavens as a set of spheres revolving around a flat earth — the thought of a Deity as outside the world, related to it as artificer to a contrived machine, was inevitable. But when the geographical discoveries of the fifteenth century coöperated with the revelations of Galileo to secure the final triumph of the Copernican over the Ptolemaic hypothesis of the world order, the ancient view of Deity as external to his creation gave place to, or at least paved the way for, the essentially modern conception of his immanence. Then, as men came to estimate as highest the moral, the intellectual, the so-called spiritual characters of their nature, crude man-likening gave way to psychomorphism, or mind-likening. Viewed as within, instead of without the universe, the Deity became a psychical being in the all-inclusive sense of that term. As man is conscious of his own acts, the world around him cannot be devoid of a like illumination. Does he himself plan? He is entitled to find intelligence and conscious purpose in Nature.

Nor is this process confined to the religious attitude alone. Science also divided Nature into separate forces, and progressed only gradually to the thought of their underlying unity. At one time it seemed as if the physico-chemical explanations contrived for the inorganic could be extended to animate things, and the ambition to unify living and non-living by a law common to both was never so much in evidence as it is to-day. But though we have passed beyond the assertion that matter contains the promise and potency of all the forms of life — already, in fact, read of the cunning which is to make vital phenomena a familiar laboratory product — the two orders of activity continue to resist intellectual assimilation. After all deductions from physics and chemistry have done their work on the organism, a residue of directive and regulating power remains unelucidated. And it is to supply this lack that, delivered from the merely verbal solutions of vitalism, we are now coquetting with the assumption that all matter is alive, and therefore endowed, in however elementary a degree, with the attributes of consciousness and will. In this view intelligence is not to be delimited by the bodies of animate beings. The molecules and atoms, perhaps even the electrons, know in some vague way what they are doing. There is a sort of sentience abroad in matter which needs only a rise in complexity to produce genuinely vital activities. Or each bit of matter, however minute, is a fragment detached from some vast "reservoir of mind." Ether, matter, energy are so much spirit; or the whole universe is a kind of soul. The cosmos is perhaps the divine Being, embodying consciousness, will, thought, plan. Perhaps the Deity is only the highest in a hierarchy of superior beings, and therefore organic.

In these ways and to this extent there is return to the ensoulment of Nature — to the primitive method of explaining the universe from life instead of life from the universe. It is for us who pride ourselves on the open mind to consider whether this projection of vitality and consciousness into the cosmos is either justifiable or necessary. Especially are we interested in the search for some grander and worthier view which shall make man not the measure, but the measurer of the universe which he aspires to know.

CHAPTER IV

THE BELIEF IN PRE-DETERMINATION

The idea of a general intelligence in Nature is founded on numerous evidences of what looks like consciously purposive control not only in the living, but also in the inanimate world. There is an order observable in the cosmos which seems to mimic the arrangements contrived by man; and it is by no means an order of the mere recurrence of phenomena causally produced, of the mere succession of events "according to law." There is nothing purposive in the "behavior" of a coin thrown up in a game of chance, yet its movements are orderly in the strictest sense. The regularity of recurrence which enables us to predict natural happenings might be shown in ways very different from those with which we are familiar: there would still be order if the sun brought darkness instead of light, or if gravitation increased instead of diminishing with the distance between the bodies gravitating. What we mean by order in the "argument from design" is a special method of order, a particular mode of recurrence and regularity, implying the use of means to an end. That nature reveals forms of contrivance which suggest intelligence, and yet have no manifest origin in voluntary effort, has long been a commonplace. We call human activities purposive when, as the result of plan aforethought, they issue in forms useful for human maintenance. Yet man has within his own body appliances thus directed in the construction of which his will has played no immediate part, and with whose functioning his consciousness has nothing whatever to do. The principles of mechanics, laboriously acquired through centuries of human history, found expression in the animal anatomy aeons before there was a sign of speech: in shaping their tools, in building their locomotives and bridges, even in utilizing the chemical and electro-magnetic forces, men unwittingly followed in the paths grooved out by Nature for the passage of the lower life. There is still less scope for voluntary effort in the plant world, yet here, in the manifold adaptations of root and stalk, of cell and leaf, of germ and flower — to one another and to the environment — the evidences of so-called contrivance crowd upon our attention. Nor is the appearance of purposiveness lacking in that vast field of the inorganic which especially concerns the chemist, the physicist, and the astronomer. Not only do the atoms, like and unlike, join each other in numerical proportions which are unvarying: the molecules which they unite to form give us the idea of a mutual adaptation, a sort of social "consensus" wherein all antagonisms of mass, weight, position and motion are harmonized. The symmetry and regularity with which these molecules "crystallize" is one of the most beautiful and familiar examples of interadaptation in the realm of matter. Farther afield the ordered unity of the atom and molecule reappears on a vastly larger scale in rounded suns and planets, in circle-like orbits and precisely recurring periods of revolution. The same mysterious power which constrains the atom to a larger allegiance has also dealt adaptively with the members of our solar family, securing for greatly differing magnitudes, speeds and intervals a minimum of mutual interference, and turning the dynamic rivalries of separate systems into the semblance of coöperation itself.

How, then, is natural purposiveness to be explained? Crude anthropomorphism has always had a ready solution of the problem, usually advanced in some variant of the saying attributed to the Vedic divinity, Varuna, "Like a clever carpenter I have fashioned all things." But these primitive interpretations need not detain us. Let us take up at once the essentially modern view of design, along with the numerous definitions of divine power with which it is associated. Several things must be premised at the outset. The mere possibility of framing the idea of an intelligent being engaged in creating or in controlling Nature cannot be accepted as an evidence of his existence, since any conception, however untenable or absurd, could thus be proved. The appeal to religious intuition or spiritual insight is invalidated by the conditions of knowledge. We have an irresistible sense of transcendent power in Nature, but no irresistible conviction that it works through consciousness and will, and certainly no inexpugnable belief that it has one definite method of operation rather than any other. Nor are its supposed general attributes thus mentally imposed upon us. The ascription of omnipresence is itself a denial of intelligent control, since it can succeed only by identifying that control with the universe. If we speak here of immanence, we dash upon the rock of dualism, for we are required to show how the "essence" which is supposed to be immanent is at once separate from Nature and in relations with it — how, in other words, the world presumed by the hypothesis to be insufficient unto itself can be supplemented by a principle or entity other than its own. If control, again, be an adaptation of means to ends, the conception of omnipotence also falls to the ground, since it has to rely on independent properties or powers in the things adapted. The very idea of means implies a Nature going its own way, and needing to be reined in, as it were, to suit the purposes of the adapter; nor can we realize the existence of an adapter save as we conceive of him as arising out of

Nature and deriving from it the very potencies and method of the adaptation.

The issue of pre-determination is squarely raised in Paul Janet's assertion ("Le Matérialisme Contemporain," p. 50), "That which is precisely most worthy of God is to have made a Nature which creates itself." We may say, therefore, either that the world resulted from creation out of nothing, or that pre-existing things were modified in accordance with an intelligent plan. Both views are self-destructive, and neither method of productivity has any analogue in our experience of natural processes. Formally we may speak of creation out of nothing, but in doing so we deny that the process is creative; so when we talk of the modification of pre-existing things, we are again trying to make a glib proposition do duty for an intelligible process. For what is creation? The notion that things may be brought into existence out of nothing is a pseudo-idea, not a real conception. To suppose a grip on nothing which would cause it to become something is to deny causal action in the attempt to assert it. All that we can rationally mean by creation is the process by which already existing things are differentiated, are taken to pieces or put together — subjected to changes of place and rearrangements of form. Creation is a reordering of ultimates that do not change. This is conclusively shown by human experiences. Our whole attitude towards power is an attitude which takes the definite qualities of things for granted; we refrain as from the impossible all effort to interfere with the nature of power. The properties of the electron, the atom, the molecule; the quantitative formulae of chemical composition; the physical behavior of given substances under given conditions; the relation of the movements of bodies to circumstances of initial energy, mass, weight, time; the general phenomena shown when matter has become organic — these are characters over which intelligent beings have no power of modification. All order, all recurrences, all so-called law in Nature manifestly depend on final elements which, through all vicissitudes of change which they buttress, themselves endure. Hence it is that while we are compelled to assume change as causally produced, by no manipulation of the conception of cause can we make it the agency of a change from existence to non-existence or from non-existence to existence. The mind thus insists on the nature of power as uncreated. But we have no experience whatever of uncreated intelligence, since intelligence, embodying consciousness and will, is a manifestation peculiar to life, inhering only in created organic bodies — ranks not as an ultimate, but arises as a product — and we cannot change its nature and make an original of it by the naïve expedient of imagining it to be infinite. To posit an intelligent being in control of Nature is to subject him as organic to the local and other finite conditions out of which organisms are known to arise. To attribute knowledge to him is to bring him as omniscient under the limitations which are denied to him as omnipresent and omnipotent.

If the universe had been pre-determined according to a consciously devised plan, we should be entitled to peer into cosmic arrangements, ask why it was thus, and suggest the possibility of other dispositions. But this line of reasoning holds good only for the mind which projects human ideas and methods into the universe. Matter in its form is a product, was created, and may fall back into the ether by reversal of the process which brought it into existence; the cosmos of power is, was, and shall be, not coming into or going out of existence, but enduring — not in space, but making space by its existence, and not in time, but making time by its changes. That it works toward ends is obvious, but this does not involve the assumption that it was originally so constructed as to eventuate in worlds, in life, in man and man's mind. Being ourselves planners, we regard the results of our planning as something that must be, however they are reached; we subordinate the causes brought to bear to the observed effect, treating them as optional, this as inevitable. But we are not entitled to fasten that naïve process upon the universe. Nor is it possible to argue for the reality of design on the ground that only from such and such favoring conditions in stellar and terrene environments could the configurations we know have emerged: we might as well claim that the course taken by a river was pre-planned because of its obvious determination by land contours, or that design is implied by the environment of a lighted candle because, without the presence of certain constituents of the air, the wick could not be ignited and would not continue to burn. Consider the concurrence of factors and properties needed to make a thunderstorm. If we have in our minds the notion that a thunderstorm, and only a thunderstorm, is to be produced, we pass necessarily to the thought of the only conditions which will produce it, and leave out the consideration that different conditions and factors would give rise to something other than a thunderstorm. It is one thing to recognize that in the absence of appropriate causes certain results will not ensue; it is another to assert that all causes are pre-determined "with a view" to the results. That the environment is to an extent fitted for the existence of bodies both living and inanimate follows from the truth that the universe is "all of a piece": through that link between them, things necessarily have environments which "fit" them, and we cannot set up in this regard, merely because of the differences between organisms and inorgana, a principle for the one which is not also valid for the other. It is only in its fundamental characters, moreover, that environment favors life, for, as we shall see more fully later, the environment may be hostile as well as helpful to living things. In the case of man, diverse changes, modifications and improvements of environment become necessary that he and his societies may succeed.

Before leaving the argument from favoring conditions, let us examine it especially in the light of adaptation. Much has been said about the importance of such factors as stellar and planetary evolution, solar heat, the presence of atmosphere and water, suitable divisions of land and sea, long continued uniformities of climate and the like. That life has everywhere taken advantage of such pre-conditions, as they might be called, is undoubted. Yet some of the fundamental and many of the superficial structures and processes of organisms have arisen as a result of adaptation to the conditions found. Without oxygen the higher organism perishes, but this truth does not involve the assumption that oxygen is there "in order that" life might appear: even granting that no other element could function as well in this particular case, it means only that living bodies, having utilized oxygen and adapted themselves accordingly, are held to dependence on it. It may be said that life itself requires a favoring conjunction of circumstances and conditions for its appearance, yet we can conceive of it as emerging under other conditions and circumstances, or we may hold that, had these been totally different from what we know them to be, something other than life, and not less wonderful, might have been the product.

Do light waves quicken through the ether because there are eyes to catch its vibrations? Is ground provided to walk on because man has legs, and a sea to navigate because he is a builder of ships? Was water made that we might drink it, or do we drink it because it is there? The atmosphere must have existed long before it was cloven by wings. There were flies in advance of the spider's net woven to snare them, and formicidae swarmed over the earth before the ant-eater gathered them in with his sticky tongue. There could have been no lack of grass when oxen began to develop grinders; there were sheep and other graminivores before the wolf and tiger had their anatomical structure specialized for flesh-eating. But perhaps there is a residuum of conditions — the general properties of matter, for example, the combining powers of the carbon atom, the mobility of protoplasm, etc. — without which life could not have appeared. The granting of the objection tells nothing in favor of conscious pre-determination: it bears on causal relations only. And we are by no means sure that life is bound in every area of the universe to the conditions of its manifestation on our own planet. Even here it shows a wide range, especially as regards temperatures; the very oxygen which supports one kind of organism is found to be fatal to another. The organic variety known to us — shown not only in differences of bodily structure, but also in unlikenesses of internal process, relational activity and habit — suggests the possibility of an even richer and more fundamental variety in worlds farther afield. Nor when pre-determination is in question, ought we to forget, along with the conditions believed to favor organic development, the absence of numberless imaginable properties, provisions, conjunctions, coöperations by which the appearance and ascent of life might have been favored. It would be convenient if we had light through the whole twenty-four hours instead of being compelled to spend a third of our day in sleep, if all matter at the earth's surface could be utilized as coal, if man had an electric sense and a telescopic eye; — to say nothing of a thousand other possibilities. This restriction of Nature's favors within limits which the human mind easily transcends is a puzzling element in the hypothesis of pre-determination. It suggests that the universe is carrying on a business of its own irrespective of the local firms which here and there, if under its aegis, set up areas of independent competition for themselves.

Nor would the acceptance of man as the highest possible type of organic existence free us from dilemma. The thesis that the production of human beings was the aim of evolution is not reconcilable with the facts. The line of life is not a continuous one; the supposed procession of all the organic types towards a single final type is to be found only in the imagination of the enthusiastic teleologist. Life has had many centers of development, if not of origin; the paths it has pursued include lines of retrogression, as well as lines of advance. In the process itself there is much to negative the thought not only of a conscious purpose, but also of the power to realize purpose. Species have been called the "embodied thoughts of the Creator," yet many have passed away without making any visible contribution to the general organic advance, while others have remained so long in inefficient stages as to put their value as evidence for design altogether out of court. All through the geological periods we find organisms whose completed structures are still in the future — pseudo-fishes, for example, whose anatomy is plainly in the experimental stages; premature mammals that give suck only at a wasteful maximum of profit; pre-ornithological birds which do not yet know how to fly — false forms that, preceding those types which biologists call true, helplessly squander the resources of life by trying to carry it on with only half-developed means. Nor are types wanting which seem to err by excess, as others by lack, of preparation — types explicable only on the assumption that the teleological purpose had its sportive moods, and that the creative fancy did not hesitate to lavish the resources of evolution on useless monsters or inscrutable prodigies. Where now the long travail of Nature that went uselessly into the dinosauria and the sauropoda, to bring forth for inevitable extinction the cetiosaurus, the pelosaurus, the ornithopsis, the brontosaurus and the diplodocus? The probability that the atlantosaurus may have needed a whole tree for breakfast, as suggested by Haeckel, casts no reproach on any doctrine of final causes; yet the existence of such forms as the ostracoderms of the Devonian, the amphibious stegocephala of the carboniferous and subsequent epochs, of the agathaumas and torosauri of the Great Cretaceous period — to say nothing of the giant armadillos, turtles and sloths — makes it difficult to take the traditional teleology *au grand sérieux.* Living animals of such form, on such a scale, with such a lack of finality in the span of life vouchsafed to them, might well serve to illustrate the splendid audacity of Nature's experiments in a period of lavish wealth. How they can be cited as the outcome of a divine plan without setting up an injurious comparison between omnipotent intelligence and the intelligence of man it is difficult to see. And only in the presence of such creatures — risen up, as it were, to affright the rest of Nature with their unwieldy bulk and preposterous armaments — do we begin to realize how profound is the truth which lurks in the naïve avowal of Agassiz that "the possibilities of existence run so deeply into the extravagant that there is scarcely any conception too extraordinary for Nature to realise."

To the charge of unthriftiness may be added that of aimlessness. No reason has been given why so many invertebrates should have been brought into existence with no chance of attaining to the advantages of vertebral structure; were man the goal, there is nothing to show why to so many mammals should have been refused the enormous benefits of the erect attitude, of hands, and of speech. The conclusion enforced by a study of organic forms is that, apart from the limited anticipations of individual heredity, in what is known as ontogenetic development, Nature reveals none of that insight into the conditions and needs of the future which is so salient a feature of conscious planning in human beings. Her work seems to be done literally from hand to mouth. The intelligent adaptations with which she provides her organisms are obviously based on the sum total of past experiences — on the conditions, that is to say, of bygone geological periods. And there is no far-sighted provision for that rainy day of evolution which threatens with annihilation the organism unable to adapt itself to new circumstances and new environments. Even when the change of condition is not radical enough to bring ruin in its wake, old structures have to be hurriedly and clumsily modified to meet the exigencies of the moment. As the nautilus is doomed to carry about with it the disused habitations of its immature past, so the "statelier mansions" needed by many a higher type of organism must be provided with patched-up additions to a structure which, from the human point of view, might have been made potentially complete from the beginning.

If pre-determination fails to realize our expectations of it in detail, what shall we say of its results viewed in the mass? Amongst several hundred species, including ants, termites, bees, birds and mammals, a comparatively high level of organization has been reached, yet in attaining this diminutive outcome, Nature had to fail on the enormous scale suggested by the two million or more extinct species of which naturalists take cognizance — a failure shown not merely by the number of structural schemes *manqués,* but also by the useless slaughter and suffering entailed. Nor is there the resource of a remote future in which the inequalities of animal destiny are to be made good. Those who regard evolution as implying a continual advance towards higher forms find the disproofs of such a view all around them. Man himself has contemplated progress towards the organization of an ideal democracy in which each individual shall enjoy like powers and privileges with every other, but the lower organic world is a realm of hierarchies, and must evidently remain so to the end. Retrogression is no less a part of evolution than is advance; the persistence of types in incipient and immature stages goes hand in hand with the gradual improvement of such types. The algae, among the earliest protoplasmic forms to appear on the planet, still form vast forests of submarine vegetation in every quarter of the globe. We still have with us the fern, denizen of the paleolithic period, practically unmodified; so the pine tree, which came into existence with the reptile monsters of mesolithic times, continues to rear its stately form in the shadow of cities and around the habitations of men. There are the like survivals in the domain of animal life. The poor and lowly, from protozoon to mollusc, crowd the blind alleys of evolution; the tribe of insects, which flourished mightily in the carboniferous epoch, is a tribe of insects still; such forms as the shark and the ray fish, continue to remind us, *longo intervallo,* of ancestors that swam in the primeval seas of our planet. Nor is it merely that certain types show no signs of advance: there are plain indications of exhaustion. That the more elementary forms have potential futures in store for them is not regarded by naturalists as probable. Neither to the sea nor to the realm of plant life can we look for new evolutionary forces. The possibilities of the invertebrata reached their limiting frontier millions of years ago. The success of man, as the dominant organism of the planet, now absolutely assured, relegates all lower forms of life to a position of hopeless inferiority. The view of pre-determination, with a human goal to be reached, thus leaves us with more than 2,000,000 species still in existence, all of them inferior yet vigorously alive, only a few of them useful to man, many of them injurious to him either directly as foes or indirectly as occupiers and consumers.

Meanwhile we are far from having the right to assume that life has reached its zenith point in man. The cosmos is wide enough, the stars are numerous enough, to encourage the belief that in countless planets other than our own the power behind the evolutionary process may have lifted matter to heights of intelligence and efficiency that outtop our own levels as we outtower the life forms farthest beneath us. Still less are we entitled to describe vitality as the most important product of universe power, merely because we happen to know it as such. It is only as organisms — systems upon which the function of self-maintenance has been imposed — creatures needing to be internally and relationally active in the work of adaptation to environment — that we come to have those recoverable cognitions and classes of cognitions which we call knowledge. For knowledge is not a solvent for the whole of reality; all it can reach are those characters of existence which, in our capacity as self-maintainers, it is useful or may become useful for us to know. Beyond, beneath and above them — perhaps out of the unfathomable richness of the ether — beings may emerge with functions higher than those of life, with powers grander than those of intelligence — beings which, misdescribed as they must be by language, wholly transcend the limited sphere in which knowledge and thought are at home.

CHAPTER V

IS THE UNIVERSE AN ORGANISM?

THE traditional account of plan in Nature frequently seeks support in the view that intelligence of the conscious sort is a universal principle, lending itself to the interpretation of existence as a whole. We find this hypothesis subsumed in the archetypal ideas of Plato, in the *nous* of Anaxagoras, in Spinoza's *idea immanens,* in the modern doctrine of parallelism, and in all the newer readings of psychic or spiritual elements into the cosmos. Now, as consciousness, will, knowledge, intelligence, mind, arise for our experiences only in organisms; are everywhere ancillary to life, not its driving power; and can be projected into the inorganic only by an error of false analogy of the very essence of anthropomorphism — the thesis which refers intelligent adaptations to intelligence on a universal scale can save itself only by ascribing life to the sum of reality. And as life may be no more conceived of apart from organic character than will and purpose can be severed from life, the ascription of natural plan to a generally diffused mind must find its justification, if at all — and a formal justification only, at best — in the view that the cosmos is an organism. A rigid insistence on what we know of life forms would require the holders of the hypothesis to show that their universe as thus conceived has external organic form, that it moves about in an environment vastly more extensive than itself, that it possesses, along with internal and relational organs, a complex system of neural linkings and a localized cosmic brain. But for purposes of simplification these requirements may be dispensed with. All the hypothesis of a conscious cosmic intelligence need be held to is the claim that the universe has organic character — that its structural unlikenesses are not mere inorganic differences, but differentiations inter-subordinated and complementary to each other, each of them having its place and conditions of development strictly delimited as the outcome of an organic end common to the whole cosmos. Such a claim, it may be pointed out, has been advanced even in the name of science, as shown by Fechner's chapter on the "Souls of the Stars and of the World ("Über die Seelenfrage," p. 148), and by the explicit assertion of Nägeli ("Die mechanisch-physiologische Theorie der Abstammungslehre," p. 576) that "the heavenly bodies are the molecules which combine into groups of lower and higher orders; and our own entire system of fixed stars is but a molecular group in an infinitely larger whole which we must conceive, not only as a systematic organism, but also as a smaller part of a still greater whole."

Now the cosmos yields to our human observation of it none of the characters which can properly be called organic. The absence of such characters is not merely noticeable — it is conspicuous. We are acquainted with the facts of our own immediate environment as causally, not as organically related to each other and to us. The air we breathe, expanding with a rising, contracting with a falling temperature; the water that sinks to lower levels whenever obstacles to its descent are removed, or ascends to cloud levels as a result of evaporation — these are no more explicable by an organic end towards which they work coöperatively than are the processes by which the boulder plunges down the mountain side, or the lava from hidden sources is thrust high above the crest of the volcano. Not vital, but dynamic interests, are subserved in the numberless thermal, electrical, meteorological and geological vicissitudes that diversify the surface of our planet. It is the merely causal connection which we admit between the cyclone and the uprooted tree, between the volcanic eruption and the buried village, between the rise of the tidal wave and the inundation of the shore. We recognize it none the less indubitably in actions and reactions less obvious to the senses, as in chemical processes that have to be imagined rather than seen. Peculiar as is chemical action — so peculiar that it is sometimes called selective — it will be found not generically unlike that displayed in the simplest juxtaposition of sand granules aggregated by the wind, or in the heaping together of pebbles on some open beach under the stress of the sea. The atomic and molecular compoundings and recompoundings may be simple or complex; they may involve merely mechanical reactions or may illustrate the play of electrical and chemical forces; yet the units come together or separate in a way that differentiates them wholly from living protoplasm. That the inorganic is a realm of physical rather than vital links is shown by the utter lack of organic delimitation found to characterize its products. In a living body organs are not haphazard, without let or hindrance: each appears where it is needed, and there is no multiplicity of production merely for its own sake. Yet on the earth's surface life forms spring up wherever the conditions happen to be favorable: the same plants are repeated wherever the soil grants a foothold for vegetation. The organism rigidly holds its parts and processes to their place and function in a general scheme. In Nature there is no such domination.

The same negation of organic character is yielded by an examination of movements that go on at a distance from the earth in "interstellar spaces." It was the fashion of the ancients to fill the void of night with the song of intelligences incomparably higher than man: from the days of Pythagoras to those of Shakespeare and Goethe, the celestial orbs have moved to the music of a *Brüdersphären Wettgesang* in a path pre-destined for them from the beginning of time. But modern science has not yet verified these poetic fancies. There are indeed constellations of a pattern intricate enough to suggest a molecular, not to say protoplasmic structure writ large; — ethereal vibrations of such bewildering variety and extent as to give comfort to the conceit of a universe brain alive with the nerve interchanges of an intelligence cosmic in its amplitude. It has seemed possible, after the analogy of the conflict between parts of the organisms, as suggested by Roux, as well as of the better known struggle between living creatures, to speak with Du Prel of "a struggle for existence in the heavens." Yet such conceptions, save in a sense to be emphasized later, carry us far beyond the facts. In no degree do modern astronomical investigations support the idea of an interrelation among heavenly bodies implying organic character: the fate meted out to the "quiring" spheres of the master poets has also overtaken the *Vorgeschriebene Reise*. There is no common center to which all of them are subordinated, and no common direction in which all of them move. Astronomers recognize numerous cases of common drift, and efforts have been made by Kapteyn to segregate star motions into two streams, whatever they may mean. But nobody has yet discovered stellar systems that depend for their structure upon other systems. The stars go their own way, even if in streams, and there is no celestial configuration which is known to depend, save in a purely dynamic sense, for its place and motions upon the positions and movements of all celestial configurations. The relation between them is inorganic, not organic.

Thus also is the nature of the relation between animate and inanimate. Plants and animals require solar heat and atmospheric conditions; the very possibility of their continuance as organisms is based on cosmically supported molecular forces. Yet neither form of dependence entitles us to assume the existence of vital characters in the environment depended upon. The facts point in the opposite direction. If the organism were related to a living Nature, the relation ought to be reversible. Now the corn needs the sun for its ripening, but there is no reciprocal dependence of the sun upon the corn field. The renaissance of the plant world in spring is made possible by the growing warmth, and so manifest is this stimulus that where, as in tropical regions, a favoring climate and temperature are never wanting, vegetation thrives and blooms all the year round. Will any one claim that the precession of the equinoxes, in which change of season originates, or even the change itself, is in any degree determined by what goes on in the world of plant life? Are we to assume that because man needs water, air and light — needs more subtly still the gravitative, electric and chemical forces — there are cosmic processes which look in any degree for their maintenance to the existence and activities of human beings? The parts and processes of an organism are reciprocally useful to each other. The dependence of life on the cosmos is absolute, but the cosmos has no discoverable or conceivable need of life.

There is the further evidence of attitude. One of the facts earliest borne in on us is the impartiality of the action of natural forces, whether these impinge on inorganic objects or on living creatures. Of this our own feelings give us the utmost certainty. Whatever theory we may hold as to the possibility of an "overruling" interference in the affairs of men — however much faith may be reposed in the hypothesis of an immanent cosmic intelligence — we always refrain, by an instructive logical inconsistency, from regarding the contact of universe forces with ourselves as personal in character. The farmer does not rage against the adverse elements that have spoiled his crop; nor is the traveler whose limbs have been shattered in a railway collision — blameworthy as he may hold some driver or signalman — prepared to vilify the power put forth by steam, or the momentum of moving masses of iron. Much as the tendencies to animism may still linger, it needs but little self-examination in our day to find that we neither envy, love nor hate natural processes. We bask willingly in the sun, and turn our cheek to the zephyr that caresses it; the new green and waxing light of spring, the mild glories of autumn — these return to us with an ever grateful freshness. And as we enjoy them, so we bear the rain that drenches us to the skin, and the snows that surround us with winter discomforts. Yet in influences toward and adverse we see nothing of a vital relation to us — only the signs of that grand impartiality, without a shadow of turning, which does so much to reconcile us to the mysterious good and the no less wonderful evil of our existence.

How, again, do we deal with such features of the external world as seem most suited to our human needs? In the daily business of life we act consistently on the belief, not only that the cosmic processes are uniform, that the "properties" of things are fixed, but also that Nature, so far as accessible, is unreservedly at our disposal for the ends of life — on the assumption that, however definite those processes may be, they are not the outcome of an intelligence striving to realize some consciously formed plan which may or may not coincide with our own. We look to Nature to supply us with all the materials and forces which we need for manipulation and are required for the external organs we call machines. That it yields itself fully to these demands is a matter of daily experience. Man has already harnessed so many of the natural powers — has so completely subjected them to his will and turned them from their own way into his that, whatever be the practical obstacles, no theoretical limit can be assigned to this form of the extension of his personality and power into the inorganic world. Yet on the hypothesis that the universe has organic character, such a surrender of itself to the needs of another and infinitely smaller organism spreading at its expense would be impossible. If there is one thing that biology teaches, it is that life as we know it requires a non-living environment as its very condition.

Not only is organic relation between universe and organism lacking: the same lack of organic dependence will be found to characterize the multifarious varieties of animate beings which thrive on the surface of the earth. The hypothesis of conscious cosmic intelligence, with its assumption of the unity of Nature, would entitle us to look for a scheme of mutual aid embracing all the forms of life. The individuals within a species may coöperate with and aid one another in the work of maintenance, yet between the species themselves we often find open rivalry, often the fiercest antagonism. The various kinds of animals may be indirectly helpful to each other: there is aid of this sort in symbiosis, where the parasitic organism lives at the expense of its host: in the familiar correlation between flowers and insects; in mimicry, so far as the theory of it is settled; and in the protection which man gives to domestic animals. But in none of these cases is there anything of the nature of organic dependence. What we find in all of them is that, while the organism benefiting has undergone a temporary adaptation, it has not surrendered any of its power to carry on the business of life for itself. Were man's assistance withdrawn from domestic animals, they would revert to the wild state and reaccommodate themselves to it; were insects to die out, plants would return to former and simpler methods of fertilization. In all interadaptations of this kind, the species concerned really treat each other less as organisms than as characters of the natural environment to be utilized in the interests of self-maintenance. We frequently read that as animals are constantly adding carbonic acid to the atmosphere, and at the same time incessantly abstracting oxygen, while plants are continually removing carbonic acid from air and adding oxygen to it, each great division of life is engaged, not only in maintaining itself, but in pouring into the atmosphere the element needed by the other. Here again we have nothing more than the utilization of conditions.

Thus far we have been dealing only with the material part of the universe, narrowly so-called. For in the popular view the cosmos has long meant only suns, planets, nebulae, comets, meteors and the extremely limited areas occupied by these. Outside of and within material bodies thus descriptively limited stretches in all its vast extent, explored and unexplored, the ether system — the real ground and source of accessible cosmic power. May not the ether, then, be organic? May it not possess — unmanifesting, since we cannot directly know it — all the characters of life, and possess them in a degree higher than any familiar to us? On these terms the ether might be intelligent, psychic, spiritual, and what not. But if the ether is to explain an intelligently behaving matter, it should be in some sort of relation with matter. If mind in Nature is to be referred to a more universal mind, the "invisible world," psychic or spiritual, should be "all of a piece" with the world which it controls. Man projects his intelligence into his environment, especially into his tools and machines. An ether system which carries none of its "organic" character into the material forms which it surrounds, connects, interpenetrates and supports, is non-existent so far as its alleged "intelligence" is concerned.

CHAPTER VI

LIFE-LIKENING, OR THE LIVE-MATTER HYPOTHESIS

The belief that plan in Nature is due to conscious purpose, refuted in the claim that the universe is an organism, needs also to be met in the form of the contention that all matter is endowed with vitality, and therefore with the power of awareness, of feeling, of will, if not of consciousness. This ascription of life to the inorganic, though it merely revives in more concrete form the disproved hypothesis, is rendered worthy of a separate refutation at once by its antiquity and by the extent to which it is still dallied with and modernized by the neo-vitalist thought of our own time. Stated more or less clearly in Greek hylozoism, it comes down to us sometimes implicated with the doctrine of a world-soul, at other times more or less limited to the ultimate material elements conceived of as separately ensouled. John Toland, while rejecting the more general conception, held that matter is at once force, movement, and life. Matter for Maupertuis is in some degree invested with the properties of living organisms; La Mettrie regards it as capable of feeling and thinking as well as of moving; Gassendi maintained that only by divining in some way the existence of another body can matter gravitate towards that body. In a chapter on "The Life of Matter," Lotze claimed that everything real is psychic in character ("*Alles Reale ist geistig*") while Büchner, from an avowedly different standpoint, regarded matter as animated by mental as well as by physical forces (*Dass der Materie nicht bloss physikalische, sondern auch geistige Kräfte innewohnen,* " Kraft und Stoff," p. 66). The position of Von Hartmann is that " the manifestations of atomic forces are . . . individual acts of will whose content consists of the unconscious representation of what is to be performed." (" Philosophy of the Unconscious." English translation, Vol. 2, p. 180.) " Since all material processes consist of the movements of molecules and elementary atoms," says Nägeli in expounding his theory of descent, " pleasure and pain must have their seat in these smallest elements. Sensation is a property of the albuminous molecules; and if it belongs to these, we are obliged to concede it to the other substances also." As Thales and Paracelsus identified activity with life, so Haeckel wrote in his " History of Creation" (Vol. 1, p. 23), that " all natural bodies known to us are equally animated and . . . the distinction which has been made between animate and inanimate does not exist," asserting further in his " Die Perigenesis der Plastidule," " Like and dislike, desire and aversion, must be common to all atoms, which can only be explained by ascribing to them perception and volition." It is Wilhelm Haacke (" Grundriss der Entwickelungs-Mechanik," pp. 22, 23) who writes: " For us life is nothing more than motion. Organic life may indeed be a particular form of motion, but it is motion all the same. And if life is motion, we may speak of inorganic life. . . . Even inorganic bodies may be ' alive ' or ' dead.' A piece of chalk is dead, but if you throw it into acid, life at once manifests itself." " *Si la cause première (l'atome) n'était pas nécessairement savante, comment,*" asks Charles Lemaire (" Initiation à la Philosophie," Tome 2, p. 11), " *concevrait-on la proportion, la regularité, l'harmonie, qui se révèlent dans les formes géométriques des mineraux, et dans les organisations diverses?* " He also writes of an " *âme du* *monde*" which realizes the unity of existence, constitutes it in a harmonic manner, and is able to manifest itself "*par un instinct, une intuition de l'ensemble dans chaque atome.*"

The hypothesis thus buttressed in opinion, is attractive by its very plausibility. The organism, we are assured, is alive because the units of matter which make it up are separately alive. It is not pretended that these material ultimates are more than on the way to becoming organisms. All that is ascribed to them, save in exaggerations of the hypothesis, is that they possess elementary powers of will and sensation. Yet it is maintained that by the union of such "living" elements into aggregates of higher and finally of the utmost complexity, the full vital characters of organized animate beings at last emerge. Appeal is thus made to a purely quantitative or arithmetical process: the premises admitted, the conclusion seems to come forth with the rigor of a logical demonstration. But the reasoning, apart from its faultiness in detail, is built on the assumption that new characters cannot appear in a material system unless they are contained, if in more elementary form, in the units of that system. What do physics and biology advance in support of such a conclusion? How shall we use it to account for those simpler chemical phenomena in which, by the same process of compounding, characters finally emerge of which the separate units give no indication whatever? Is it the atom of oxygen, for example, or the unit of hydrogen which is watery? Does the lead atom or the gold atom contribute brittleness to the compound formed of these two elements? How does it happen that when magnesium unites with the oxygen of the atmosphere highly peculiar phenomena arise not shown separately either by oxygen or by magnesium? If a "living" atom may combine with other atoms equally alive to form a living creature, why may it not be possible to analyze the organism into constituent parts each of which is a model in miniature of the organism thus composed? How may the flower be explained save on the assumption that it is made up of units each of which has something of the flower character, or the foliage of a tree save on the assumption that a vast number of minute leaves have gone to the formation of the trunk? If the science of chemistry has taught anything, and the plain facts of biology are of avail, they show beyond peradventure that it is rather the rule than the exception for new qualities and forms to appear as the result, not of mere arithmetical accumulation of characters already present in the combining units, but of new relations set up by such accumulation. Nor are the conditions of the problem changed by the recent division of the atom into electrons, for the live-matter hypothesis is logically compelled to read will and sensation into ultimate units, however minute and evasive these are found to be. If it is a collection of these units which are collectively alive, then the hypothesis falls to the ground; if vital characters are to be discovered in each ultimate particle, then we cannot, by merely exchanging the word "atom" for "electron," escape the objections which make the hypothesis untenable.

It is frequently asked how live matter can come forth from matter which is "dead," just as it is constantly urged, with arguments controversial rather than rational, that intelligence cannot emerge from a cosmos devoid of or unsupported by intelligence. A sufficing reply to such questions has already been offered. Note in addition that the phrase "dead matter" contains an implication which destroys its value even for controversial purposes. Carrying with it the sense of something from which life has departed, it loads matter with the reproach of a vanished principle which it never possessed. Inorganic matter is neither dead nor alive: it certainly cannot be called dead on the ground that it was never alive. What is it for a material aggregate to be living? It is not for it to be a mere collectivity, since all inorganic systems are made up of collocated units. It is certainly for it to carry on the activities we call vital, and for these collectivity is indispensable. Now the individual material ultimate is not amenable to any such description. However explained or formulated, by no manipulation of unit properties can life processes be deduced. This has been well shown by John Veitch ("Lucretius," pp. 64–66):

> Are the atoms, with their supposed or real powers of mutual attraction and combination, sufficient of themselves to account for the synthesis of bodies which we find has actually taken place in experience? Supposing force to produce or pass into motion and synthesis of elements, and supposing chemical forces to effect combination of atoms so as to form wholly new compounds unlike either of the original elements, we have another important step before us ere we can get any complex structure, say plant or tree. For every definite form constructed depends only ultimately on the mere force or motion of its elements. It depends proximately and characteristically on the mode, direction and determination of the molecular motions. The absolute variety, as well as definiteness of organic form, depends on the direction of the motion, and on direction limited and completed in a unity. Ere the plant arises in the symmetry of its perfect beauty, each molecule must take a definite direction and path; it must fall into fitness with its neighbor, and all must submit to a final limitation; otherwise there would be no definitude of life or flower, no individuality of plant or tree. But this is not all implied in the fact that there are molecules mutually attractive, or primary force capable of passing into motion in any direction whatever, or as another force lies.

Then there is the simpler yet fundamental requirement of collectivity and the no less indispensable requirement of coöperation. Vital characters emerge, not as the mere summation of individual properties, but as the result of vital relations set up between units organically aggregated and jointly carrying on the activities of self-maintenance. Life forms, however minute and apparently structureless, are just such self-maintaining systems; it is these self-conserving activities which really constitute life. But the material ultimate is not to be confounded in its powers as an individual with the coöperating pluralities which it may aid to form. The inorganic unit, call it corpuscle or electron, has no activities of self-maintenance to carry on. Maintained by the cosmos as a whole, it is at the disposition of inorganic forces to be pushed or pulled, to be moved or placed, according to purely physical modes of action and reaction. The determination of it to position or motion, that is to say, is dynamic and external. It does coöperate in an elementary way as member of a universe of power units each of which is needed by all, all of which require each; but it has no organic relation to anything outside itself. As we cannot explain social phenomena by saying that each human individual is a social phenomenon independently of and prior to society, so we cannot explain life, which is fundamentally social, by saying that vital phenomena are present, even in any degree, in each separate element of a material system before that system has begun to display the characters of life. And we are only reverting to the same *impasse* when we try to endow our ultimate with psychic powers. It is not sensation, awareness, will, that make life, but life that calls will, awareness, feeling into being.

One more plausible suggestion remains at the disposal of those who read vitality into inorganic matter. It is reached by regarding crystallization as an intermediate stage, a sort of half-way house, between so-called inanimate things and the realm of life, the view proceeding on the assumption that if the atoms and molecules were freer than they usually are in inorganic bodies they would to a greater or less extent display vital characters.

And the crystalline structure, wherever found, is held to represent the advance which, under favoring conditions, inorganic matter is making towards the higher forms and manifestations of life. Haeckel's presentation of this attitude shows the soul-endowed atoms on the way to becoming organisms. He describes all crystalline bodies as "intermediate," saying ("History of Creation," Vol. 1):

> All vital phenomena and formative processes of organisms are as directly dependent upon the chemical composition and the physical forces of organic matter as the vital phenomena of inorganic crystals. (P. 406.) The differences which exist between the simplest organic individuals and inorganic crystals are determined by the solid state of aggregation of the latter, and the semi-fluid state of the former. Beyond that, the causes producing form are exactly the same in both. This conviction forces itself upon us most clearly if we compare the exceedingly remarkable phenomena of growth, adaptation, and the "correlation of parts" of developing crystals, with the corresponding phenomena of the origin of the simplest organic individuals (monera and cells). The analogy between the two is so great that, in reality, no accurate boundary can be drawn. (Pp. 412, 413.)

The analogies between crystals and organisms are certainly impressive, and it has been shown that there are liquid as well as solid crystals. The crystal repairs itself, if mutilated; it increases in bulk if the necessary fluid be present. The manner in which crystals thrown into suitable liquor "cause" the production of similar systems, each crystal giving rise to its own type, is held to resemble the way in which microbes multiply. But in spite of these analogies, the fundamental difference between crystals and organisms remains; and the interval between them, instead of growing less, has been expanded by every advance in biological research. "The study of the cell," says E. B. Wilson ("The Cell in Development and Inheritance," p. 330), "has on the whole seemed to widen rather than to narrow the enormous gap that separates even the lowest forms of life from the inorganic world." Instead of crystallization being a form of life, it is obviously a way which matter in the fluent condition has of solidifying — the assumption by material particles of a particular geometrical form. The organism grows; the crystal increases, and its increase is due to the activity of the parts added, as well as to the activity of the crystal itself. The principle of the impulsion to growth is within the organic system; the principle of the increase is alike in the crystal and in the fluid that bathes it. The organism takes in matter to replace molecules removed or metamorphosed in the activities of self-maintenance; in the crystal there is no such change of parts which it is the function of increase to repair. The increase of a crystal, moreover, is only in a physical sense determined by the crystal as a whole; nor is there invariably a demand in a crystal for augmentation of bulk which becomes satisfied, so to speak, by such augmentation, or by any degree of it: a crystal is in the same state of dynamical equilibrium whether it be large or small, whence the process of increase has no time limit at which it must come to an end. Then the characters which distinguish the crystal from the non-crystal are characters of form, whereas the characters which distinguish living protoplasm from inanimate matter are also highly specialized characters of acting, of process. In the crystal, the form is all-important: in the organism the function is all-important. The crystal has no youth, maturity or old age; there is no limit fixed at which it must divide; its so-called growth is simply a spatial building up in mosaic of continual repetitions of itself which might go on indefinitely. The crystal, in a word, is a structure which shows us the naked properties of inorganic matter and the relations which aggregation sets up between them; the organism, however lowly in the scale of life, presents itself to us as a self-active, quasi-spontaneous and self-maintaining system. And with this difference goes a likeness which is much more than an analogy. It cannot be doubted that the process which gives rise to crystalline formations is fundamentally one with the inorganic process from which life emerges. In this sense the crystal is an elementary anticipation of the organism which it mimics — a sort of connecting link between the organism which maintains itself and the self-maintaining universe. But the completest recognition of this fact does not further the live-matter hypothesis by a single stage. It certainly gives us no warrant for assuming that if, under protoplasmic conditions of complexity and mobility, crystals were to become organisms, their promotion to vital rank would be due to a separate endowment of each of their molecules or atoms with the powers of sensation and will.

Life-likening, or biomorphism, as it may be called, is only a subtler form of anthropomorphism. It must be regarded as a hypothesis rather of defect than of fulfilment. The very presentation of it is an admission that the universe is all of a piece, and that the organic must in some way arise out of the inorganic. But as to how the transition is accomplished — by what transmutation of merely inorganic into genuinely vital characters — the adherents of biomorphism have not yet ventured even to suggest. And in the difficulties met with — perhaps in despair of any solution at all — the teleologists in science and out of it have taken one of those royal roads that lead nowhither. The assertion that matter in its very nature is "alive" and has elementary psychic properties, remands all hope of a rational comprehension of vital phenomena. It pushes the problem farther back. It treats a causally derived product as an unoriginated ultimate. It is an attempt to make a formal proposition do duty for a real explanation.

CHAPTER VII

THE COSMIC ANTITHESIS

THE view that matter is alive, that the cosmos is an organism, that conscious intelligence is a sort of universal principle, that the "reason" of the universe is of the same kind with that of man, finds its separate negation in the conflict which common as well as scientific experience discloses between the total world of inorganic things and the limited realm of life. In considering this contradiction we must avoid the error of overlooking those aspects of cosmic power which support material existence and are essential to the activities we call vital. What is here meant by conflict is not the antagonism which is of the deepest nature of things, but such conflict as is shown either when one set of processes retards, nullifies or annihilates the results which would be reached by the unhindered operation of another set, or when processes are so lacking in solidarity with each other that were the conception of their intelligence admissible we should be entitled to describe their relation to each other as one involving antagonism of interest.

That such a conflict between realms dynamically one should be provided and tolerated in a scheme of guidance applied to the whole universe is inexplicable. Yet that inorganic and organic represent different orders of existence, each working out some of its end in defiance, so to speak, of the other, is not open to serious question. The living creature, while buttressed in the inanimate as the very foundation of its activities, is none the less opposed, limited and often overwhelmed by the very cosmic power which is at once its source and indispensable support. The consummate adaptations which make up so much of the beauty and wonder of life forms do indeed tell of a final success against all odds. But while it is thus possible to humor and utilize Nature, she cannot always be depended upon; and her smiling face, with the dagger ever ready to strike, disposes us to moralizing even in our most poetic moods. Beyond the influences to which the organism has adjusted itself with relational organs and internal processes, there are determinations of environment to which, on account of their irregularity or suddenness, there can be no possible adaptation. It is certain, as the traditional teleology reminds us, that without the upheaval of continents from the primitive sea, only the marine life could have been developed; yet it is just as obvious that neither geological processes nor ocean waves have been stayed to conserve any flora or fauna, however biologically promising.

Science has yet to inform us that such vicissitudes have been governed in any period by the interests of living things. It recognizes no provision of factors uniformly favorable to life, and not the slightest sign of factors consciously planned to secure the advancement of life. Nature's gifts are bestowed not on superiority of structure as such, but on fitness for the conditions, whatever these may happen to be. If the conditions are favorable, Nature works them out into progress; when they are adverse, she leaves the devil to take the hindmost. An advance all together, secured by the might which makes right, is sure of survival; on many a variation which merely contains the promise of progress is inflicted what Casimir Delavigne calls "*l'inexcusable tort d'avoir trop tôt raison.*" Says Huxley ("Evolution and Ethics," p. 32): "If our atmosphere were to cool again, the survival of the fittest might bring about, in the vegetable kingdom, a population of more and more stunted and humbler and humbler organisms until the 'fittest' that survived might be nothing but lichens, diatoms, and such microscopic organisms as those which give red snow its color; while, if it became hotter, the pleasant valleys of the Thames and Isis might be uninhabitable by any animated beings save those that flourish in a tropical jungle. They, as the fittest, the best adapted to the changed conditions, would survive."

The attack of the inorganic forces on the citadel of life begins in the very foundations, and here it is that the most helpless are the least protected. Seeds and germs, whether of plant or animal, leave the body of the parent to be exposed immediately to a host of fortuitous determinations. They are carried off by rain, wind, fire and flood; they decompose on the ground or find a suitable nidus only to be devoured or destroyed in a hundred ways. Even when chance spares them to maturity the slaughter goes on. Of birds Wallace says ("Darwinism," p. 267): "The destruction commences, and is probably most severe, with nestling birds, which are often killed by heavy rains, or blown away by severe storms, or left to die of hunger if either of the parents is killed. . . . Of those which migrate in the autumn a considerable proportion are probably lost at sea, while those which remain with us are greatly thinned by cold and starvation during severe winters." And he adds: "Exactly the same thing goes on with every species of wild animal and plant from the lowest to the highest. All breed at such a rate that in a few years the progeny of any one species would, if allowed to increase unchecked, alone monopolize the land; but all alike are kept within bounds by various destructive agencies so that, though the numbers of each may fluctuate, they can never permanently increase except at the expense of some others, which must proportionately decrease."

Out of this process of excessive increase which has to be corrected by a process of destruction — the latter adducible as an evidence of plan only on the assumption that the former is beyond control — comes insecurity of life and waste of life on a colossal scale. Listen to Jefferies: " In the meadows the careless spendthrift waste of grass and flowers, and of all things, is not to be expressed. Seeds by the hundred millions float in the air with absolute indifference. The oak has a hundred thousand more leaves than necessary, and never hides a single acorn. Nothing utilitarian; everything on the scale of splendid waste! Such noble, broadcast, open-armed waste is delicious to behold. Never was there such a lying proverb as that enough is as good as a feast. Give me the feast; give me squandered millions of seeds, luxurious carpets of petals, green mountains of oak leaves. The greater the waste, the nearer the approach to real life! "

All of it eloquent of the conflict between inorganic nature and the realm of intelligence, since the squandered resources of life represent, not the bounteousness of a careless provider, but rather the efforts of the organism to produce germs in such abundance that, in the presence of adverse influences however numerous and threatening, some at least shall survive and insure the continuance of the species.

Nor is the conflict suspended when the environment to be dealt with consists of animate beings. Success in circumventing the inorganic simply prepares the organism for a new enemy armed with will, potent of death on a world-wide scale, and not for a moment influenced by ethical purpose or conscientious scruples. Take an illustration from the life which, being most luxurious and also most beautiful, has given much inspiration to the mythmaker and the poet. In his " Naturalist on the Amazons " (pp. 35–38), H. W. Bates observes that there is " plenty in tropical nature to counteract any unpleasant impression which the reckless energy of the vegetation might produce." Yet "in these tropical forests each plant and tree seems to be striving to outvie its fellow, struggling upwards towards light and air — branch, and leaf, and stem — regardless of its neighbors. Parasitic plants are seen fastening with firm grip on others, making use of them with reckless indifference as instruments for their own advancement. Live and let live is clearly not the maxim taught in these wildernesses." It is the same writer who cites a statement of the German traveler, Burmeister, to the effect that "the contemplation of the Brazilian forest produced on him a painful impression on account of the vegetation displaying a spirit of restless selfishness, eager emulation and craftiness. He thought the "softness, earnestness and repose of European woodland scenery" (showing Nature brought under the control of man) "were far more pleasing, and that these formed one of the causes of the superior moral character of European nations." So Charles Kingsley tells in "At Last" how impressed he was by "the mob-like rush of great trees in whose fight for air and light egotism reigns supreme," by "overreaching tyranny, a temper which fawns and clings so long as it is down, and when it has risen, kicks over the stool by which it has climbed." "In such a crowd," says Rodway ("In the Guiana Forest"), the weaker is trodden under foot. And when the forest giant gets old and feeble, his comrade enemies come round him in force. He can no longer continue the struggle, and quickly succumbs, perhaps to two or three of his children who have grown up under his shade." It is of mimicry that Drummond is speaking when in "Tropical Africa" (Chap. 7), he says: "Carlyle in his blackest visions of 'shams and humbugs' among human kind, never saw anything so finished in hypocrisy as the naturalist now finds in every tropical forest. There are to be seen creatures not singly, but in tens of thousands, whose very appearance, down to the minutest spot and wrinkle, is an affront to truth, whose every attitude is a pose for a purpose, and whose whole life is a sustained lie. Before these masterpieces of deception the most ingenious of human impositions are vulgar and transparent. Fraud is not only the great rule of life in the tropical forest, but the one condition of it."

In water, then, on land, even in the air, the species prey on each other with a reckless disregard for the lives of individuals that puts all thought of solidarity and general plan in organic nature out of court. Within the species there are coöperative activities in plenty, but between them, outside of symbiosis and certain adaptive relations, open war rages. The plant, from root to crown and from seed to bud, is at the mercy of the insect; the insect is picked off by the bird and the bird destroyed by enemies two-footed and four-footed; the quadrupeds themselves yield everlastingly to pursuit by the strong-jawed members of their own kind. With man comes the destroyer aided by science and armed with both weapons and excuses. It is nothing that his patent lawn mowers reap the flowing grass, or that his axes gather in the forests. The higher organisms have also been bestowed for his especial use. His hunting knives must make straight the way for civilization; he needs game when he is not hungry and sport where there is no carnivore to make him afraid. It is in the interest of commerce that he persecutes the plumaged bird, and that his fleets still go down to the sea with poisoned harpoon, howitzer shell and explosive bullet. For such beautiful or mighty organisms as the seal and the whale, the bison and the giraffe, the elephant and the deer, he has already prepared the fate which he long ago meted out to the stately moa, the great auk, the dodo and the solitaire. Nor is he merely content to kick over the ladder of the lower life on which he has mounted to supremacy. He sweeps the ancient tribes of men from his path and, turning his bayonets and machine guns against himself, fills history with the records of human slaughter. He rests from campaigns but to plot them anew: the more advanced he is in the arts of peace, the mightier become his resources and his preparations for war.

Now it is impossible to reconcile these evidences of conflict, of retardation, of waste, with the hypothesis of consciously intelligent direction by all-knowing and omnipotent power. And there is nothing — save the assumption that Nature is something for itself, which destroys the hypothesis — to set aside other modes along the lines of which evolution might have proceeded. Insistence on plan does not preclude the idea of development without disharmony and contradiction. It is idle to tell us that war is the "father of things"; for while we know it is, the possibility of another ordering and of an altogether different process is subsumed. Slaughter and suffering are not desirable ends in themselves; even the human intellect recoils from the economics of a scheme which destroys thousands of carefully nurtured organisms to secure the maturity and survival of one. As a physical world is imaginable in which the laws would be unlike those with which we are now familiar, so a realm of life otherwise determined could be easily conceivable as logically within the power of intelligent omnipotence. At least original peace could have been made with life by the skies, by the earth and the sea; the lion and the lamb could have lain down together from the beginning. Human existence need not have been harrassed and tormented; nor need the days of man have been numbered, save as he grew endlessly in the capacity for effort and in the enjoyment of happiness. His very felicity might have been founded, not on the ephemeral pleasures of the vegetative existence, but on the strenuous working out of beneficent plan, and on the lasting delights of the mind.

Plainly enough do we see how the anthropomorphizing intellect comes to be caught in the toils of its own attitude. No sooner has it insisted on a personally originated and guided universe than the contradictions involved load it with a fatal embarrassment. But the difficulties and the reproaches are for us alone. They arise not out of the cosmos, but from the scheme which we are ourselves trying to foist upon it. The universe is irrational and unethical only when and just because we project ideas of intelligent determination gathered from our own experience into a territory where they are not and can never be at home. The method of evolution may be called "unwise" only by assuming the existence of a capacity for wiser ordering that was left unexercised; our "Why was it not otherwise?" is a mere variation of that "Why is it thus?" which cannot be even asked. The world is neither the best nor the worst of all possible worlds. Such wisdom as it has includes the wisdom of being eternally determined by its own nature, and therefore sufficient unto itself; such development as may take place within it must be the outcome of that nature without help or guidance from a principle other than its own. It is not ill, but well for us that the cosmic foundation is subject neither to the capricious interference of voluntary action nor to the disturbing incidence of human opinion, and that the conflicts which seem to retard its unfolding, the harmonies towards which it unceasingly works, alike come forth from elements which, whatever changes they may buttress, themselves eternally abide.

Ethical considerations belong exclusively to us, are pertinent only in the realm of behavior; the moral approval or prohibition comes only when motion has emerged from the realm of the inorganic into conduct. Implying life, and the relations to each other of living beings; implying also a high complexity of life, with its associated degree of intelligence; the ethical requirement is peculiarly a human phenomenon. It is the demand which the social system makes upon the social unit, the compliance needed for the well-being of society and the self-adaptation required for the welfare of the individual. And even in man it is subject to development, being at its minimum where interdependence is least, and at its maximum where interdependence is greatest. This explains why the ethical conduct which is expected of the individuals within a nation has thus far received only an imperfect application in the field of internationalism; it also shows the error of extending moral judgments to species of plants and animals which, representing incipient stages of intelligence, live in organic isolation from each other. And the expectation of ethical behavior in the cosmos is only an exaggeration of the error of applying human standards of conduct to the life lower than that of man. It is true that without the wonderful exactness, precision and inevitableness of inorganic quantities, processes, actions and reactions, no morality could arise and no ethical standards could have validity. In this sense the cosmos is related to all the phenomena of life as foundation to superstructure. And it is just in this sense that we find in it not the doing of right, but the rightness of doing — not a justice liable to the mistakes of conscious and voluntary action, but a justness which is as much beyond praise and blame as it is beyond error. To call the universe moral is to subsume an adaptation of itself to the demands of some larger system than its own, and therefore to subject its presumed totality to an infinite regress of ethical requirements. And when regard is had to the impossibility of viewing "cosmic interests" as rounded off in the development of life, and that on a single planet, the universe presents itself to us not as beneath intelligence and sub-ethical, but as higher than intelligence and super-ethical.

CHAPTER VIII

VARIETY IN NATURE

One of the problems which is insoluble when left to the anthropomorphizing intellect alone is that of the lavish variety of organic forms. Here two suppositions are possible. If we take the view that species were developed as means to the appearance of man, we are confronted with the powerlessness of omnipotence to reach its ends save through the sub-human. If we regard species as originated without reference to man, the question of their use to themselves and of their place in the economy of things is just as much of a puzzle. The mystery deepens as we examine organic Nature in detail. The hypothesis of general plan entitles us to look for absolute command of resources and exhaustive knowledge of the whole field, with no necessities of revision and no possibilities of failure. None of these expectations are realized. The assumption of omnipotence is negatived by the something which organisms everywhere are for themselves; the creative power, whatever it may be, shows the wisdom of *faits accomplis,* but none of the foresight needed to support the claim of omniscience. Nature proceeds from failure to success through experiment; her organic adaptations, based on past experiences, take no account of the future. Her plans are numberless, and she has many ways of doing the same thing. It is not only that different organs perform the like function — the same organs often perform different functions. A general plan should show a single artificer and complete unity of method. What we see is a vast number of workers each shut off into a separate compartment and each active, so far as organ-fashioning is concerned, independently of the rest. Granted that there must be organisms adapted to living in the most varied environments, with the widest differences of accommodation to those environments — from the insect for whose limited vision a tree trunk is a realm to the eagle which overlooks a whole continent, from the radiolarian disporting itself in a drop of water to man adventuring for intellectual merchandise to the farthest stars. Let us have organisms fixed and organisms locomotive; living creatures of the sea, the land and the air. Give us all the tribes of life, with their cilia, flagella, fins and wings — with their legs and their no-legs — and let unlikenesses of habitat, if you will, explain their tribal peculiarities. But what of the variety of structure and appliance within the same environment, or the divergence of method when the end to be accomplished is precisely the same?

Consider the extraordinary differences which plants present. The variations of leaves in size alone is striking enough, since it ranges from the tiniest blade visible only through a magnifying glass to the leaf of the jaguar palm of Orinoco, fifteen feet long. Then note the variety, in shape, venation, and arrangement of the stem, in these breathing organs of the plant. We get a mere glimpse of it in leaves circular, like those of the alder and aspen, elliptical as in the cherry and beech, ovate as developed by the honeysuckle; in the cleft leaves of the lady's mantle, lobed leaves as in the oak, the palmate leaves of the horse chestnut, the pinnate leaves of the locust tree and vetch, and the perforated leaves of the philodendron — leaves with smooth margins, as in the iris and laburnum, toothed as in the strawberry and birch, armed with spines as in the holly and thistle — leaves like needles in the pine, like foot-rules in rye and oats, like swords in the gladiolus. Note also the endless variety in the structure of flowers, where a single example suggests a thousand — here single floral envelopes, there two, yonder none; calyxes of all kinds, rotate in the buttercup, cup-shaped in the rose, bulged in the campion, cylindrical in the thorn-apple, spurred in the Indian cress, downy in the thistle and goatsbeard; corollas regular and irregular, resembling a salver in the phlox, like a funnel in the convolvulus, strap-shaped in the chamomile, forming a tube in the comfrey. Who will maintain that each of these special structures so fits into a particular environment, and is so sprung from and adapted to it as to be essential to the very existence of the plant which has it in use? Is it not plain that the ends compassed — common to all the species and varieties concerned — could have been attained by a far less lavish variety of both method and structure?

Multifarious modes of reproduction, not one of them absolutely essential for the continuance of the species, suggest the same problem. If there be general plan, whence the variety of appliances to prevent self-fertilization and secure cross-fertilization — the variously shaped receptacles in which the nectar is stored, the numerous modifications of stamens and pistils, here forming insect traps, there operating by irritability or elasticity? If a row of hairs or a pungent odor will secure one plant from unwelcome visitors, why should another have to produce a glutinous secretion for the same end, or a slippery ascent that cannot be traversed? "What," asks Wallace, "of the strange springs, traps and pitfalls found in the flowers of orchids which cannot be necessary *per se,* since exactly the same end is secured in ten thousand other flowers that do not possess them?" ("Natural Selection and Tropical Nature," p. 145.) In one class of seeds the dissemination is insured by a sticky or glutinous exterior, in another with the aid of passing cattle by means of "hooks." If twenty thousand species of plants can be reborn by means of a one-seed leaf, why should eighty thousand others require a leaf of two seeds? Some plants enclose their seeds in edible fruits that animals may be attracted, others prevent the devouring of seeds by surrounding them with coverings hard, prickly, or disagreeable to the taste. We see fruit developed from different parts of the floral envelope or of the ovary, the calyx becoming enlarged and fleshy in the apple and pear, the receptacle itself swelling to form the strawberry, the integuments of the ovary increasing in bulk, as in the plum, peach and grape. When a dense mass of flowers could be utilized in producing the compound fruit of the mulberry, why should the method be varied for the pine, the apple and the fig? Was it the same mind which planned the yielding strawberry and the hard-shelled coconut, the fleshy involucre of the peach, and the walnut's bitter rind? Some seeds need merely to be liberated from the parent plant; others, like the vetch, the furze, the garden balsam, and the squirting cucumber, must be projected from their containing capsule; still others require for dissemination the fluffy parachute of the dandelion or the long feathery awn of the clematis; or the distribution is committed to a special wing-like appendage, even to the leaf itself. When a crown of hairs is produced, it arises from the calyx in the valerians and composites, from the perianth in the bulrush, and from the crown of the seeds in the epilobiums. The seed of the sycamore has two wings; the pine and the fir develop only one.

Turn to the animal world. The need of experiment, recognizable all through organic nature, is especially seen in the structure of wings. The pterodactyl, among the earliest of bird forms, stretched a web of skin from the body to the tip of the elongated outer finger; the bat supports its sail-like web with four fingers; the true flyer, dispensing with the web, perfects last of all the feather-covered wing. The maximum of efficiency and economy for air flight seems to have been reached with two wings in the diptera and the bird, yet there are whole species of insects which insist on the four-wing method of propulsion. "Bivalve shells," says Darwin, "are made to open and shut, but on what a number of patterns is the hinge constructed — from the long row of neatly interlocking teeth in the nucula to the simple ligament of a muscle!" Hair-claspers in the certain ascaridae arise by modification of the hind legs; in other ascaridae the same organs are produced by changes of the maxillae, the lips, and other bodily appendages. Does the beetle need a prehensile organ? — it is variously developed by refashioning of the jaws, the tarsi, the front legs, or the tibia. The luminous organs of insects are differently located; in fishes provided with electrical apparatus the "batteries" are not only variously constructed — the nerves supplying them proceed from different sources. Insects' organs of smell are found sometimes in the wing, sometimes in the antennae or the proboscis. For grasshoppers and crickets the ear is in the leg; for the locustidae it is in the first segment of the abdomen. One crustacean at least listens with its tail; another's sensitiveness to sound is located in one of the antennae. Then there are the strangely diversified organs of vision, all functioning for the same end — from the simple ocellus and compound optic to the eye of man — the essential difference between the typical vertebrate and the typical invertebrate eye being, says Lubbock ("The Senses, Instincts and Intelligence of Animals," p. 142), "that while in the former the optic nerve penetrates the retina and then spreads out on the anterior surface so that the rods point away from the light, in the normal invertebrate eye, on the contrary, the nerve spreads out on the back of the retina so that the rods point towards the light." Is the call for varieties more urgent?

They are amply supplied by the sting of wasp, bee, hornet; the poison sac of the snake; spines, beaks, claws, teeth; the tusk of the boar, the spear of the narwhal; the bony shield of the armadillo and crocodile, the bristling *cheveux de frise* of the porcupine. And if the appeal be made to examples from the organic processes, we have them abundantly as modes of reproduction, with a range extending from the simplest types of fission to the most highly organized forms of sexual reproduction — here hermaphroditism, there parthenogenesis, oviparous birth alternating with viviparous, the direct method of reproduction contrasting on the one hand with alternation and on the other with metamorphosis.

What of variety, viewed as a means to the end of securing the highest attainable intelligence, that of man himself? Granted that the work of "evolving" human capacity was committed to a process of cumulation, modification, unfolding and adaptation from the beginning. Let us accept as necessary to this process a line of ascent along which life must travel — forms fitted to a marine, then to a land environment — air-breathers succeeding to water-breathers, back-boned animals arising from invertebrates, the quadruped at last liberating his forefeet for manipulation to win, handed and erect, with powers of speech and coöperation, a final dominion over the whole realm of life. Add to the human equipment cattle and poultry for food, the horse, dog and cat for helpers and companions; crops for cultivation, flowers for decorative purposes; even a few tribes of beneficial bacteria. The amplest provision in these respects would leave hosts of highly specialized organisms utterly unaccounted for. It is impossible to see why a biological tree developed for its crest alone should have been weighted with so many and such wide-spreading branches. What organic nature shows us is an apparently reckless outflow of life without any sort of guidance save that of opportunity, and with no curbing control save the pruning-hook of death. The process has produced man, but it has also saddled the earth with forms unprogressive in themselves and too frequently hostile to human interests — a vast establishment of organisms not content to be mere remainders — shavings, as it were, from the carpenter's workshop, — but insistently busy in occupying the space and eating up the food which man might have utilized to much better advantage. As one best way, rather than numerous methods of doing the same thing, might have been adopted in the functioning of plants and animals, so in the production of tribes of organisms a selected few, beginning in generalized forms, would have sufficed for the goal in view. Had mere variety for its own sake been guarded against, man would have been protected from manifold scourges which still beset his upward path. The whole brood of noxious weeds and noxious bacteria, all inadequately typified by the cholera germ, the potato blight, the mosquito, the house-fly and the plague-breeding rat, could have been sacrificed without serious injury even to the interests of scientific research. What the sportsman might have lost in the opportunities of the jungle would have been the certain gain of civilization. And if a plea be advanced for esthetics, it must be remembered that the animal world is sometimes most beautiful where it is most deadly, and that even its innocuous beauty shades off into the monstrous and the repelling. Taste in color and form might have been gained from organisms less fatally endowed than the serpent and the tiger, and man could have framed his own ideas of the grotesque without resort to the stupid penguin, the extraordinary aardvark, or the flamingo on stilts. He need not have been puzzled by Nature's attempt to supply the marsupials with pockets, to build a watch tower on the shoulders of the giraffe, or to turn the proboscis of the elephant into a hand. In the care taken to surround him with the graceful in shape and motion, he might have been spared the clumsy flop of the kangaroo and the unesthetic shuffle of the orang-outang.

Observe now where this variety of method leads us. If the numerous species of living creatures were guided in their development from without, as assumed by the teleologists, the dominating intelligence which they posit must have worked with comprehensive knowledge of the whole field, and in accordance with a general plan taking cognizance not merely of one or a few, but of all the tribes of life. How fatal the facts are to the thought of any such over-ruling unity of treatment may be seen in the nature and working of the only higher intelligence which is known to us — the intelligence of human beings. It is only in the earlier stages of social development, and in the lower stages of intelligence, that we find this luxurious yet wasteful variety of function and process. So far as knowledge is concerned, the tribes are there connected with their past by little more than tradition; they are just as imperfectly linked to the contemporaneous life of the human family, since languages are isolating, there is no literature, travel is rare, and commerce has scarcely yet begun. Thus separated, the human divisions do not modify each other, and each is free to develop endless peculiarities of speech, dress, tools, customs, religions and ideas. But as man ascends, as the tribes come together, and as relations arise between races and nations, men's ways of doing and thinking come under the domination, as well as the illumination, of a more comprehensive experience. There is not only an assimilation of the particular human society to society as a whole; the members of each society, little as they may be conscious of it, bend to the sway of the larger allegiance. There is an ampler variety of product, because of the multiplication of demands due to the increasing complexity of life; but the tendencies to excessive differentiation are checked, methods are universalized, and mankind emancipates itself more or less completely from the narrowing influences of local conditions and special environments.

This progress is especially well shown in tools and industrial appliances of every sort. As the speech of savages is free to vary from generation to generation — so free that travelers revisiting a tribe after a few years find a whole language modified — thus also is it with primitive tools, which show, not only intertribal differences, but also the variety imported by each individual worker and by those who succeed him. Consider the differences of chipped flints, no two of them alike in millions; then compare them with the uniformity of our modern table knives, also turned out in millions. Examine the whole repertory of the instruments of savage or barbarous races — their knives of bone, slate, stone, bronze, and iron — hatchets, hammers, adzes, chisels, "shaves," drills, borers, awls and needles; fishing and hunting appliances; their dugouts, kayaks and outriggers; their baskets, pottery, tools for agriculture; their cudgels, darts, bows, arrows and other weapons. All will be found to vary from tool to tool, from worker to worker, and from tribe to tribe. Then contrast with these divergences the uniformity of product, surviving diversity of function, which characterizes the implements wrought out when intelligence is not only organized, but in a far larger measure social. We get then not only similar tools and machines, but also methods of working which pass unmodified from centers of manipulation and manufacture to the ends of the earth. The savage is largely confined to his own experience, to variations inseparable from handwork, to the diversities imposed by his local surrounding. The modern producer, closely connected with the whole past and present, avails himself of the accumulated results of invention, and commands the resources of all environments. The watch is essentially the same wherever manufactured. The pump, the steam-engine, the dynamo, the aeroplane, do not need to be built on one plan for the tropics, and on another for the colder regions; nor do they need to vary in structure according as they are destined to operate in valley or on mountain, in forest regions or in treeless steppes, where the air is dry or where it is moist. The larger the intelligence, the more does it eliminate the varieties due to individual experience, to diversities of material and environment, the more does it provide for the most general uses under the widest differences of condition, the more does it introduce and universalize like methods of accomplishing the same ends. What enormous saving of both energy and material results from this expanded application of mind to production may be realized by considering the waste which would be involved were each human tool and machine wrought out as a variant in correspondence with some difference of local condition — adapted, that is to say, to each particular individual or group of individuals who were to use it — to their size and strength, or to the kind of experiences which had been theirs — to the particular village, town, city, country, or to the very street and domicile in which they happened to live. Yet this is precisely the process which has been followed in the production of organic adaptations.

The psychomorphic view of design in Nature requires us to apply intelligence to the problem, and the rigorous application of it destroys the view. The appliances with which living creatures carry on self-maintenance must arise from within — they cannot be developed from without. Intelligent adaptations need for their development what may be called organic freedom — freedom not from ultimate cosmic determination, but from all guidance other than that wielded by the organisms themselves —

freedom therefore to have experiences of their own and to deal with found conditions in ways best suited to insure self-maintenance — freedom, in a word, to carry on the business of existence for themselves. Any outside intelligent power imagined as coming in to guide the living system in its adaptations would have to be credited with all the experiences, individual and collective, of all organisms whatsoever — a supposition which identifies the assumed control with the objects controlled, and yet denies the unity of the control by taking for granted the thousands of ways in which animate beings, developed to circumvent each other, as well as to maintain themselves, strive to bring each other's intelligence to naught. Nor can it be urged that we have an example of the external kind of creative control in artificial selection. The breeder develops many sizes and shapes of dogs, but they always remain dogs; he may change or modify the wool of the sheep until, from being useless for his purposes, it grows fine and silky, yet it never ceases to be wool. And it is only by utilizing the powers of the organism that even these superficial changes can be brought about. They are themselves, in fact, adaptations to the conditions. In the very act of making them, the lower organism triumphs over the presumed control of man.

Organic variety is one of the results of this freedom from guidance in things where the only possible guide is the organism itself. Like adaptations do not come forth from different experiences save in an imaginary world, and to fit all plants and animals with the same appliances would be to ignore the very nature of life as self-maintenance, and therefore as requiring the self-adjustment of each organic type and set of experiences to its particular environment. If a free field is given to change by the very exuberance of life, it is given only as all general causes are free to be what they are by nature: the same guidance which could restrain the appearance of variety to a few original lines of ascent would be just as rationally engaged in restricting the operation of electro-magnetism, chemical affinity or gravitation. The uniformity of the tool and machine must be referred to the fact that, being constructed for all the users of it everywhere, the human appliance can be suited only to the most general conditions; the variety of the "intelligent adaptation" arises out of the fact that it is determined not only by the organism using it, but also by the special conditions of that organism. Differences of method result from the variety of ways which Nature offers for securing survival. The lavish richness, then, of natural forms is a reproach only in the view that it is produced by a consciously working power which is unable to make unlimited knowledge of the factors and supreme command of the material effective. With the psychomorphic attitude relinquished, the same variety is seen to be an unplanned provision against chance, an undesigned method of trial and error, through which ascending vitality reaches its goal. The organs of plants and lower animals, issuing from the particular environments and experiences of each, represent the most primitive order of intelligence with which we are acquainted. How then may we regard them as the outcome of a mind infinitely higher and more resourceful than that of man? If conscious intelligence is at its fullest and grandest as a power of origination and guidance — either transcendent over the cosmos or immanent within it — why should the conferred intelligence begin at its lowest and least perfect in the realm of life?

CHAPTER IX

CHANCE IN HUMAN AFFAIRS

The teleologists who are fond of telling us that the universe is "governed by law" need to be reminded that chance is also a factor in cosmic arrangements. Their appeal to law, with its anthropomorphic implication of a lawgiver, is itself based on the error of false analogy. Laws are man-made prescriptions which, originated to delimit human conduct, change as human conditions and human opinions change: they have no real parallels in Nature. What we describe in our clumsy symbolism as "natural laws" are regularities of process which repeat themselves without essential variation. To read powers of guidance into them is to say that action is determined by its method; to speak of the universe as being under the control of law is as erroneous as to regard the form of a planet's motion round the sun as the cause of that motion.

The order of Nature, so far as we have knowledge of Nature, is a causal order, the changes in which involve action and reaction. All of them are cosmically caused — they arise ultimately out of the cosmos as a whole. It is the general characters of the universe that work out in the end what may be called natural plan. But this general drift is made up of subsidiary causes, and it is among these that there is conflict — a conflict of inorganic processes among themselves, and a conflict between organic and inorganic processes. The universe has dynamic, but no organic solidarity. The various regions of the inorganic, while in the minute interdependent, in the large do not always respect each other's activities. The intelligent adaptations which should result in given areas from the operation of general causes are subject to retardation, sometimes to disruption, by other parts of the system. Subjectively viewed, chance is the event which cannot be foreseen or predicted; objectively, it is the changes which interfere with each other — the conflict which is seen where some process comes in to embarrass or nullify another process that would be worked out if left unhindered.

We recognize this fortuity first in the universe at large, where each inorganic area, though receiving its delegated powers from the cosmos, goes as it were its own way — not separated from the general drift that makes for natural plan, but unsubordinated to any organic scheme assigning to each its proper function, its "thus far and no farther." The appearance of "new stars" in the heavens, however we may explain the phenomenon, reminds us that the process of world formation may be delayed or complicated, as well as assisted by inrushes from without or by outbursts from within; it is the same cosmic power to which the harmonious adaptations within the solar family are due that is ready, according to the astronomers, to destroy its own work by bombarding the system with a "dark sun." So, on the earth's surface itself, a single torrid summer may dry up the beneficent lake, as a landslide or an upheaval may dam the stream on which secular interchanges between cloud and sea depend. A thousand unplanned occurrences fault the geological strata, abort the crystal, and turn the chemical processes in new directions. The advent of life does but magnify the interference. The lower the scale of sentience, the vaster is the potency of chance; the less developed the power of self-adaptation to fortuitous determinations, the greater must be the sacrifice of immature organisms in the work of species maintenance. The excessive reproduction thus rendered necessary to make up for waste is gradually diminished as intelligence rises, yet the remedy of more cunning adjustment always has chance arrayed against it; even for the human level fortuity remains an ever-impending flood.

Men themselves seem hardly less at the mercy of Nature's hostile moods than is the poorly equipped and unenterprising animal. They succumb to earthquakes and volcanic eruptions, are overwhelmed by tidal waves, need weather bureaus to warn of the coming cyclone, dikes to save their cities from being engulfed, artificial fires to deliver them from the icy death and artificial streams to protect them from the conflagration. They escape the lightning and the sunstroke only to be carried off by famine; they exterminate the wild animal only to fall victims to the microbe. The jungle passes, but the disease epidemic remains; science grows from more to more, but the need for preventive medicine multiplies its tasks, and the hospital is always with us. Progress in guarding the human organism from these hostile determinations must indeed be admitted: the rate of human mortality has been for some time past on the decrease. Yet added risks to life and limb have come in to offset the advance with an increasing number of "casualties" — accidents of road, river, railway and factory — whereby human beings are fatally suffocated, burnt, crushed, scalded or otherwise prematurely destroyed. Tools and machines, by complicating his activities, do but introduce man to chance on a wider scale. He dikes off the ocean, but the turned switch wrecks his train; his factory wheels replace a million brawny arms, but his boilers explode; he has leviathans that defy wind and wave, yet his aviator rides to death on the aeroplane. Invention shrinks the countries to neighborhoods, and navigation is at the mercy of a miserable fog; it utilizes the ether for speech, and the world's whispering gallery is hushed in silence by the gleam of an aurora borealis. And this conflict with the colossus is seen in the minute as well as in the large. The unseen nail that jags the cutting edge of a plane or the knot that spoils the plank of the cabinet-maker; the insulation flaw which ruins the induction coil or sends the optical glass to the melting pot; the bubble in a casting that brings down the bridge; the river snag costing hundreds of lives — these are all cases of chance.

The organic is subject to interference by the inorganic because the two belong to different planes in the causal order — because animate beings have no organic solidarity, are not in one piece with the unliving nature which is their environment. But there is chance also in the animate realm itself for the reason that living creatures are less separated from each other than they are sundered from the non-living environment. And the separation, greatest where the species are most unlike, is sufficiently in evidence within each species, since every moving member of it is subject to the fortuities that arise from the presence and movements of the other members. Note that the organic bond is lacking even where intelligence and social solidarity are at their highest. Were human beings closely enough interorganized to form a "social organism," each would have his function and activities rigidly assigned, and the "social unit" would show experiences as uniform, as regularly recurring, as those of its cells, tissues and internal processes. Such a collocation of the individuals of a community, each under the guidance of a general plan, would practically exclude chance save as it consisted of invasions from the inorganic world without. Human individuals do coöperate in the activities of social maintenance; human doings do reveal uniformities both spatial and temporal. But the connection between such activities is only slenderly organic. Possessing a separate nervous system and brain, the immediate originator of his own movements and therefore relatively free in them, unhampered by close juxtaposition with his fellows, with a field of influence wide as the social system itself, the individual encounters fortuity in the sphere of his human surrounding on a scale of vastness which he rarely appreciates.

True it is that chance is not invariably hostile to man. The natural selectionist maintains that without it there could have been no species development. The same chance which provides the savage with a club ready-made vouchsafes the traveler a road through the mountains, or endows some port with a convenient breakwater. Many remarkable inventions, a few great discoveries, have arisen out of the concurrence of fortuity with human cunning. But the problem is not that of balancing beneficent casualties against those which are injurious. Even if it could be shown that the "skirts of chance" are always "happy" — always offer themselves to be grasped with advantage to the individual and the race — we should have good ground for questioning the wisdom of the arrangement. It is not casualty, but certainty, on which human progress most depends. The highest mind known to us shows itself, not in the ability to make a bargain with accidents, as if their régime were to be enduring, but in the power to push on in the work of eliminating them. A universe in which purpose is consciously and omnipotently enthroned should yield us a higher, not a lower degree of this power; yet we look to it only to find chance most in evidence where we are entitled to expect it the least. That the dice box should have place in a process of such importance as the development of life is not reconcilable with the thought of an overruling conscious guidance in Nature at large. The only reasoning known to us rejects the thesis that success or disaster for man should at any time depend on the thrust of fortuitous conjunctions, or on the mental toss-up of a coin at a fork in the road.

But there may be danger of exaggerating the incidence of chance on human affairs. How much? There is first the divisionalization which personality involves, and then the determination of personality by heredity — on the one hand that wonderful localization of a particular set of conscious experiences in space and time, on the other the hardly less wonderful compacting into a single human individual of physical and mental elements immediately contributed by two individuals, yet traceable ultimately to all individuals. In the Weismann theory — "if that hypothesis of theirs be sound" — the aim or end of nature is to pass on the reproductive germ-plasm from generation to generation as nearly unmodified as possible, the soma, or general body of the organism existing mainly as a sort of by-product to insure the transfer and keep the plasm of life continuous. Whence it has been urged that heredity, prepotent over all the influences of environment and all the mechanisms of education, throws the entire hope of the race on that slender possibility, the process of selection for marriage. Now what two individuals shall unite to continue the race is at once the most important and the most neglected of all human problems. In perpetuating plants and animals the breeder chooses carefully with a view to the improvement of the organism; in the breeding of men the choice is usually committed to the swift promptings of passion, to social or pecuniary interest, or to the chaotic entanglements of chance. The lure of an hour-glass waist, of an eyebrow or a fine set of teeth is not always diminished by prudential considerations; and so long as human welfare may be outweighed by the merest triviality — perhaps the aroma of a perfumed letter or the airy lightness of a moonbeam — marriage and giving in marriage will remain a blind panmixia out of which superior endowments emerge by exception instead of by rule.

In nothing more helpless than in the power to select the age or the conditions into which he shall be born, the human individual is not a whit more potent to determine the physical, mental, moral characters which shall be his. If we do not think it fair to put a functionary into office laureled with credit or saddled with responsibility for the achievements or shortcomings of his predecessors, why should we regard Nature as ethical when we find her conferring or withholding endowment by the mere inertia of transmission? It is indeed the custom of the world to throw the sop of " equal opportunity " to those who suffer from the lack of equal powers. But fear rather than welcome should await so delusive a gift. The only benefit bestowed is that of the equal submission of each to an original favoritism which differentiates all; the only freedom exercised is the opportunity to work out Nature's primordial unlikenesses into their inevitable unlikenesses of result. Equal opportunity is often the opportunity of chance to make the most or the least of ourselves, and therefore our opportunity to rise when we are strong and fall when we are weak. Visible in every act of patient self-sacrifice, in every heroic deed, in every contribution to human advance by individual or nation, it is also seen where wanton wrong and moral ugliness go hand in hand, where *force majeure* triumphs over right and fraud dominates merit, where the vile drag down the great, and the most miserable accident of position and circumstance is allowed to tell in favor of the worst at the expense of the best.

It is through chance, again, that the very powers thus unequally distributed either fail of development or find inadequate application to the buiness of life. How long must Becquer's dust-covered harp await the " *mano de nieve* " that might pluck music from its cords? How long for the potential astronomer sung by Shelley — born "to mould a pin and fabricate a nail" — shall the stars remain mere

> Specks of tinsel fixed in heaven
> To light the midnights of his native town?

Even when Ruskin's "oppressed royalties of captive thought" and action have been liberated, the desirable correspondence between capacity and achievement is rarely secured. An ideal education would insure, not only the full unfolding of dominant aptitudes, but also their adequate utilization. The perfectly trained individual would be he whom the educational process had enabled to give himself most efficiently to social service, and therefore he whose special capacities had been carried to their highest degree of development. Fitness for function in a society of innumerable functions should be aimed at in all training of the young; yet education has not yet begun to address itself seriously to the task of noting and perfecting individual endowments. It results less from the care taken to insure a general culture than from the economic wastefulness of teaching large numbers *en bloc,* with inadequate individual attention, that pupils are turned out from educational establishments each better prepared to do what everybody else can do moderately well than to do what he alone can do supremely well.

Open as the career may be to talents, it is accident which largely determines how talents shall be employed. A father's proficiency in a given activity frequently burdens the son with a life-task to which his endowments are inadequate; young men who might shine in business or in industry prefer the "respectability" of the learned professions; even the clerical office has been more than once filled through the laudable desire of pious parents to make clergymen of their boys. The passion for justice does not always qualify for the law, nor does the desire to make a living, united to much that is unselfish and humane, invariably adjust the medical expert to the calling of his choice. Do we hail it as a triumph of adaptation when the politician is rewarded with a post, or the diplomat is selected for his wealth? And the chance which brings a relative success in positions for which men are imperfectly fitted is matched by the fortuity that excludes the competent from places in which they would achieve the highest success. A moderate proficiency in the wrong task usually operates as a disqualification for the right task; the perfect adaptation of the individual to occupation is so rare as to have little or no determining value as a motive to choice between the fit and less fit. A vast amount of human capacity is thus lost through not being utilized, or through being utilized in the wrong callings. Far more of the world's work is done by half competent men wrongly placed than efficiently by competent men in the right positions.

It has been urged that hostile fortuities, alike in Nature at large and in human affairs, supply the element of adversity which is needed for progress — that without them man would have no fulcrum for his lever. For motion there must be resistance and the overcoming of resistance; for the ordering and manipulation of things, things to be ordered and manipulated away from tendencies and collocations of their own into collocations and tendencies imposed by man; for the triumph of intelligence, accidents to be provided against, casualties to be foreseen and diminished, chances to be circumvented. But the admission of this merely serves to bring out all the more strongly the difference between the human process and the natural process. The method of conflict as a means of advance is certainly not of man's contriving. He aims to remove obstacles from his path, not to encumber it with difficulties. His journeys are not arranged so that highwaymen may meet him on the way; he is not solicitous that his sea trips shall be beset with perilous billows and hostile winds. He erects no mountains that they may be pierced at tremendous cost, and runs no rivers to stay his march that the science of the engineer may be developed in bridging them. What should we think of a scientific man who preferred chance to uncertainty in his investigations; of an inventor who worked disorder and disturbance into the very fabric of his machine; of a statesman who contrived, along with cherished schemes, influences to antagonize them; of a nation which sought to spread its commerce by fomenting native opposition, or to manage its colonies by fostering revolts?

Personal explanations of Nature, whichever way we turn them, result in a mass of contradictions. The moment we attempt to assimilate " cosmic intelligence " to human intelligence the two methods fly apart. But here again we find our embarrassments in the teleological hypothesis itself, for these burden us only so long as we insist on viewing the universe and its arrangements as under the domination of a consciously operating, intelligently directed will. Renounce the expectation of a sort of magnified human behavior in the cosmos, and most of our difficulties vanish. Building on what Nature offers to us rather than on what may be read into it — seeking in the universe our explanation of man rather than in man our explanation of the universe — we recognize chance as a mode, not as a disturber of the cosmic order, as an essential element of the objective reason at the foundation of things — that reason which secures the unerring equivalences of action and reaction, and through ever-continuing superficial vicissitudes keeps unchanged those ultimate dynamic quantities and qualities out of which life and intelligence finally emerge. As antagonisms are of the very nature of power, so conflict is an inalienable factor in the coöperations, inorganic and organic, that make for progress. The adversity which stimulates endeavor without weakening the ability to perform is not a curse, but a boon. Without fortuity we should lack the guide to adaptation, without waste the inducement to economy, without discord the signpost to harmony, and without evil the impelling incitation to good. In a universe whose supreme justification for being is the fact that it exists, man is nurtured into a freedom only short of spontaneity, and chance offers an inexhaustible field for his expanding intelligence. Unequal distributions of endowment and condition paralyze only when, regarded as personally inflicted, and therefore unjust, we perpetuate and intensify them by our own neglect. Ours it is to recognize them as the outcome of a universe order more important for us than its occasional exceptions, and more precious to us than our own comfort. The problem of fortuity perplexes only so long as we remain content to shift to a super-human realm the responsibilities we should ourselves shoulder as men.

CHAPTER X

THE FOLLIES OF HISTORY

When a rock is riven by a dynamite blast, there is no denial of contrivance in the fact that the fragments fly hither and thither to unpredestined places: the end aimed at is the bursting of the stone asunder, not any definitely directed collocation or dislocation of the débris. But when a world is planned for the habitation of man, we are entitled to look for studied utilities of structure and configuration, and to look for them even more insistently — having regard to the vastness of the interests involved — than we should expect signs of prearrangement in the planning of a dwelling or the laying out of a city.

Now our map of the earth, little as we may have verified it by travel, reveals a purely haphazard building up of the planetary materials, and such a division of them into land and sea as makes the notion of underlying plan of the conscious kind in their arrangement not only untenable, but even absurd. That three-fourths of the earth's surface should have been reserved for fishes and "monsters of the deep," and only one-fourth of it spared for occupancy by human beings, with large areas of that fourth ice-covered or otherwise uninhabitable, cannot be called either equitable or intelligent. Vitality may begin in the ocean, granted. But when a drop of water suffices for the "culture" of millions of bacteria, it is mere trifling to suggest that the greater areas of two continents were needed to secure the origination of life.

Even where continents emerge from the sea, they are so strangely shaped and diversely located as to suggest, not order at its sanest, but caprice at its wildest. How shall we account for the fantastic configurations which make up our western hemisphere — that Siamese twins of planetary architecture whose uniting ligature the surgery of the human engineer has been called on to divide? On what hypothesis of forethought for man are we to explain the extraordinary jumble of contours which geographers call the eastern hemisphere, with its unwieldy continent stretching from Scandinavia to Bering Strait, its north vanishing into glacial inaccessibilities, its southern coasts distorted into preposterous pendents, peninsulas and *culs-de-sac,* the ungainly bulk of Africa hanging from it by a thread, and the continent of Australia put into the scheme as if by an afterthought? What demiurge in his senses would have tortured the earth's periphery into the shapes we know as Europe — contrived that vertiginous downward bend of Norway and Sweden, planted the clubfoot of France on the back of Spain, shaped the grotesque leg of Italy, and drooped the islanded hand of Greece into the land-locked Mediterranean?

But we need not take counsel with esthetics, or blame for the lack of decorative effects. The concern for us is what these distributions and configurations mean for human development. Of especial import is the separating influence of the oceans, for the seas not only waste space in the sense that vast areas of them might have been better utilized in providing footholds for man — they bar off the peoples from each other, and delay world-assimilation for thousands of years. Nor is it merely that the earth's Hawaiias, Polynesias and Micronesias have been so long held off from the currents of progress by their engulfing environments of water. The great continents themselves, afflicted or advantaged by climate, show all varieties of the partiality which has distributed men into habitats and differentiated them into types. That they should be hemmed in by mountain ranges or loosed to the freedom of plains, cursed with barren tundras, steppes and deserts, or dowered with forests, smiling landscapes and waving crops; confined to fishing, admitted to agriculture or promoted to pastoral rank; held back as nomads or advanced to the opportunities of city life; condemned in the Arctic to the miserly denials of Nature or in the Tropics to its lavish and degenerating opulence — all this is clearly determined by conditions of origin which, if we were compelled to trace them to acts of will, would be unhesitatingly referred to malevolence aforethought. The notion that fair play, to say nothing of justice, is represented in these locations and differentiations will not bear a moment's examination. On what theory of equal opportunity were territory and numbers bestowed on the Chinese and denied to the Italians? Why should the enterprising and thrifty Swiss be "cribbed, cabined and confined," and the Russians have a vast continent to grow up in and dispose of? Whose was the overruling decree which so long refused separate nationhood to the gifted Irish and harnessed the hardly less gifted Poles and Finns to the chariot wheels of autocracy in a planet where the tiny republic of Andorra could call itself independent? The claim that conditions are there to be tamed, improved, utilized by man is a surrender of the case for plan. And if we are to put historic optimism to the test of saying that impassable mountain barriers and dividing leagues of ocean stimulate the development of intelligence — through the art of navigation, for example — it might as well be maintained that the Nile was fashioned that Egypt might have the benefit of culture, or that France was separated from England in order that the British might wax strong and defeat their rivals at Trafalgar and Waterloo. Perhaps an atmosphere was bestowed on the planet not that man might be an air-breather, but that the aeroplane might be invented.

It has been said that the end of isolation was the development of sturdy, efficient races. Why have we neither ethnic nor intellectual contribution from the natives of Tasmania, New Guinea, Australia? Is Iceland a leader in world progress? Or favored races were to become leaders, China, Arabia, India being held back from the quick upburst of civilization in Europe that culture might go out therefrom to the ends of the earth. The backward peoples were to be lifted by the more advanced. How do the Maori, the Sandwich Islander, the Indian, and other vanished or disappearing types support the hypothesis? But isolation favored the development of powerful stocks by protecting them from attack and disruption by other stocks: hence advance, if only in limited areas. Who protected all the stocks from the thirst for plunder and the lust of conquest? And how shall the theory of general plan convince us that it was the same mind which contrived the assault and elaborated the means of defense? Has the Almighty a powerful antagonist, or must we degrade our conception of him to the level of suggesting that he is playing a game against himself? We never suspect that the builders of Gothic devised Saracenic architecture, or that the Parthenon and the Taj Mahal came out from the same mould. Why should we believe that the ferocious Malay and the humanized Greek, the man-eating Aztec and the Christianized Norseman, the embruted Australian and the philosophic Hindu, had the same maker? Surely with William Blake we may pertinently ask again regarding the " tiger, tiger, burning bright ":

> Did He smile His work to see?
> Did He who made the lamb make thee?

Whatever the process, men were evidently destined for coöperation. But coöperation requires likeness, and difference spells division. What isolation did was to turn men out from special moulds of climate and environment as if with the purpose, if conscious purpose be insisted upon, of keeping them eternally apart. Out of this cult of variety for variety's sake, based on local conditions and the fighting law of Nature, came those differences of speech and thought, of social structure and political system, of ethical conceptions and religious creeds, which make the coalescence of human beings for common welfare, even after thousands of years, the despair of the wisest. It is from such fruits of differentiation that we inherit the curse of devastating wars not yet lifted, the hateful distrusts and discriminations of color and race not yet stilled or soon likely to be stilled by the softening influence of commerce. Think of the saving of friction, of time and of life that would have been effected had the energy spent in making races, like languages, polysynthetic, monosyllabic, agglutinative, inflectional, or non-inflectional, been devoted to insuring the development of fundamentally harmonious types, activities and ideas. With mankind thus made essentially of one race, rather than "of one blood," there would be no peculiarities of physiognomy to hurt the esthetic sensibilities, and no unlike valuations of human worth to wound the sentiment of justice. We should not see barbarism juxtaposed with civilization, or despotisms cheek-by-jowl with republics. Social systems would not clash, and there would be no irreconcilable conceptions of right. Relieved from the specialization of local environments, and speaking a common language intelligible the world over, men would come together not in distrust, but with sympathy, and not for conflict, but for coöperation. The unification of the races, with its vast economies and yet more alluring humanities, might thus have been secured from the beginning. It is a plain negation of the thought of guidance, whether beneficent or merely overruling, that the ideal of "liberty, equality, fraternity" was left to be worked out in defiance of the decrees of Nature by the intelligence of man.

But grant that the geographic conditions were the best that could be provided by omnipotence; concede that human unlikenesses and divisions had to be foreseen by omniscience. The races must have been guided after their differentiation. How far, and how effectively? If we are to assume that *Völkerwanderungen* like those which made Europe everwhelmingly Aryan were carried on under intelligent control, a totally different explanation must be contrived for the successive barbaric invasions which swept over the occupiers after they had settled. That the world's Leonidases, Alfreds, Hampdens and Washingtons were needed for nation-building must be admitted; but into what far-sighted plan for the good of peoples shall we fit the Attilas and Alarics, the Chingis Khans and the Tamerlanes? History shows us, along with benefits contrived, the machinery needed to subvert them. The armies of Cambyses reach out to overwhelm Egyptian culture, and Greece in her palmiest days is exposed to the assaults of half-barbaric Persia. Rome, after carrying her civilization over the known world, succumbs to the Goths and Ostrogoths, to the Visigoths and the Vandals. Hordes of invaders pour over the Alps to punish Italy for her "*dono infelice di bellezza,*" and she contributes art and science to the rest of Europe only to be rewarded with the loss of her independence. England's tyranny drives her American colonies into revolt, and the new nation that springs into being from the clash divides against itself in a terrible war. In France the madness of a reigning house precipitates the orgy of a revolution, and out of it arises a military despotism which the world powers have to suppress. As the folly of a usurper led to the Franco-Prussian war, so the folly of a policy brought on the Boer war, the folly of a government the Russo-Japanese war, the folly of a politico-religious dynasty the Balkan wars, and the folly of a military caste the great war which began in 1914. What is the rule of all these examples, which suggest a hundred others? Clearly that in human affairs chance is sometimes more potent than direction, that success may be determined by might as well as by right, and that national as well as individual greatness is decided not by motive or merit, but by the event. There is, indeed, a survival of the fittest in history, as there is in Nature. The Persians would have been the fittest if Darius had won the battle of Marathon, and the Greeks had lost to Xerxes at Salamis; the Huns if Attila had been successful in the Catalaunian Fields; the Saracens if the Franks had not defeated them under Charles Martel; so also Louis XVI if he had dominated the National Assembly, Napoleon if he had outgeneraled the combined armies of Europe, and George the Third if his forces had suppressed the American patriots and outlawed Washington.

Some of these were incipiencies, commencements, experiments. The "modern" period should come nearer to our expectations. What of it? Are the peoples adapted to each other, is friction eliminated to the vanishing point, are efficiency and economy secured, is there harmonious working within and without as the final product, for these are the goals aimed at wherever intelligence guides? The twentieth century ushered in new manifestations of the sentiment for international peace, yet never before in its history was the world more mightily engaged in preparations for war. Set off against Hague conferences and arbitration treaties, as if laughing them to scorn, we saw campaigns for the conquest of territory, competitions for "spheres of influence," and scrambles for any loose baggage of race that might still remain to be shouldered as the "white man's burden."

Triple alliances were needed to protect European states from being overreached; triple *ententes* sprang into existence to save them from being overwhelmed. It took "balances of power" — so unstable was the peace equilibrium — to keep the nations from acting like highwaymen, and even this resource was shown to be ineffective. No safeguard yet devised relieved us from the "war scare," an almost daily obsession; yellow perils alternated with brown and black perils; leaders of European civilization lived in constant expectation of invasion or attack; and over the whole western imagination the East hovered with the terror of an ever-impending flood. Peace intervals simply shifted the emphasis to tariff wars, to struggles between parties and factions, to the strife which arrays the masses against the classes. It was then we heard most loudly the clash of industrial states contending with political states, of great combinations defending themselves against governments and governments engaged in curbing combinations, of laborists arrayed against capitalists and capitalists organizing against laborists, with care for public interests emerging from the conflict by exception rather than by rule. And beneath it all — so little is man sure of the right road after centuries of "progress" — sound in deep undertones the warring systems of action and of thought — individualism against collectivism, anarchism versus socialism; pluralism opposed to monism, empiricism contesting rationalism, idealism irreconcilable with realism. Yet it is man all through, tragedy and comedy mixed — man liberated from his paleolithic periods of intellect and his chipped-flint stages of Nature knowledge into contradictions that multiply with the growth of his brain, and absurdities that put even his own intelligence to confusion — man dowered with useless art in his very infancy and denied the useful arts until he is "mature"; early an adept in destroying life, late an adept in saving it, his gunpowder and cannon long preceding his steam engines and dynamos, as his arrows and swords long preceded his antiseptics and his antitoxins — man solicitous for the freedom of the soul ages before he shows any care for the freedom of the body, defending the right of opinion and the right to human property in the same breath, ready with an army to achieve liberty or to maintain serfdom, ready with a statue for the martyr of free thought and a scaffold for the revolting slave.

Perhaps religion was conferred to soften these asperities and contradictions. The signs of its harmonizing effects are far from apparent. Here also we meet with the variety due to division and the distrusts, hatreds and hostilities that spring from variety. Had men been superhumanly guided, we should have been able to trace at least a thread of concord woven into their religious ideas, methods of worship, institutional forms and outlook upon Nature. What we do find is a veritable jungle of heterogeneous elements, none of them springing out of any real necessities of human condition or of human life. An appearance of uniformity does emerge from the stages traversed by the religious mind, but there is no obvious reason why man should pass through animism, fetishism, and polytheism in order to reach monotheism, any more than there is a reason why a modern university student should be taught that the sun goes round the earth as an introduction to the Copernican theory, or that disease is caused by demons as a preliminary to the practice of bacteriology. Were earth-worship, fire-worship, moon-worship, star-worship, ancestor-worship, demon-worship, saint-worship distributed for separate and special needs by a guiding intelligence, or must responsibility for them be fixed upon man fighting his own way towards rational conceptions against a nature which, in this deepest of human problems, has left him hopelessly in the lurch? If Christianity be the highest and truest of the world religions, why Buddhism and Mahommedanism, and whence the clashing crudities of Confucianism, Taoism, Shintoism, Mosaism, Zoroastrianism and Mazdaism? Who ordained the rival gods with their irreconcilable attributes, and out of what unified plan for the race as a whole came forth the Amun-Ras, the Baals, the Mithras, Ormuzds, Allahs and Jahvehs, the Dyaus-pitars and Brahmas, the Zeuses, Jupiters, Peruns and Odins? Even in its most refined form, monotheism splits into deism and theism, into trinitarianism and unitarianism; while for doctrine and denomination alike, all the modern faiths, *mutato nomine,* have their Arians, Gnostics and Nestorians, their Jacobites and Marionites, their Basilidians, Collyridians and Sabellians. To many races and nations the truth is divinely revealed — in the Shu-Kings, the Shi-Kings and the Li-Kis; in the Vedas and Vedantas, the Zendavestas, the Korans and the Al-Gazzalis; in the books of Mormon and the Testaments old and new — but the story they tell as holy writ varies so from manuscript to manuscript that it is impossible to believe all the communications were inspired by the same mind. And if it be asked how religion is administered under the different prescriptions, the answer shows that it loses none of its conflicting elements by being transmuted into practice. Consider the luxuriant variety of its functionaries — here, medicine-men, soothsayers, dream interpreters; there, prophets and high priests, bishops and no-bishops, secular popes and popes spiritual; yonder, black clergy and white clergy, a priesthood to which marriage is permitted, another on which celibacy is enjoined. Or take into account its methods, with their thousand differing symbols of gesture, ritual, image and creed, from magic to prayer, from oracles to augurings, from circumcision to baptism, and from burnt offerings to pilgrimages and processions. True that the most extraordinary forms of belief and worship serve to unify, but the unity produced within the group does but serve to intensify division between the groups, and from religious differences to religious hatreds, from religious punishments to religious wars, it has never been more than a step. Has tolerance always been promoted by religion? Ask of the Husses and Jeromes, the Cranmers, Ridleys, Latimers and Servetuses. Does religion secure interracial and international peace? Read of sword-propagated Mahommedanism, of the Crusades and of St. Bartholomew massacres.

If these are our evidences of consciously intelligent plan in history, what subtle powers of contrivance do they reveal? Where the adaptation of means to end? Is waste eliminated and economy secured? Show us a trace of the efficiency which even the least resourceful human inventor weaves into the very fabric of his machine! Such questions disclose our point of view and reveal the source of our dissatisfaction. Absurdities, inconsistencies, avoidable waste and preventable suffering — all these bulk large enough in human conduct to challenge every available human effort to the task of their diminution and removal. But the "follies" of the process itself are for our own way of viewing it. To trace that process to any form of superhuman personal guiding is to bring it within the purview of judgments based on the analogy of consciously directed effort; to recognize it as proceeding from the very source of consciousness and will, these derived, that sublimely free from the limitations of human intelligence, is to conceive worthily of the process, and to deliver it from the reproach which man transcends only as he is able to transcend anthropomorphism, biomorphism, psychomorphism. It is of the very essence of the idea of intelligent control that in advance of its operation, things, organisms, men, have a nature of their own, since intelligence functions only for the needs of life, and intelligent direction or contrivance is a diversion of things from the way in which they would go if let alone. We know of no such control exerted over man other than that which may be put forth by living beings in the interest, immediate or remote, of self-maintenance; the absence of any external organism functioning for guidance, as well as of any relation of man to an all-inclusive organism, is obvious. The supposed guidance of human development, moreover, points directly and inevitably to human automatism. A superhuman control, in however modified a form, would paralyze human effort; logically carried to result, it could dispense with the self-activities on which personality is founded. Human activities would illustrate the crude determinism which connects the parts of a machine with its maker.

If we regard the interference as immediate, we supplement the manifest interplay of organism and environment with a superfluous agency endowed with inconceivable power and knowledge; if we posit predetermination, we find ourselves compelled to view guidance as the result of an after-thought, brought in to remedy deficiencies which should have been foreseen and avoided from the beginning. Like plants and the lower animals, man requires organic freedom as the very condition of his development — the freedom of his own nature, the freedom of influence by local environments, inorganic and organic, the freedom of his actions and his thoughts. Out of the depths come the conflicts which he would remove, the delays he would hasten, all of them beyond reproach in the degree that they are relieved from organic control, and all forming the resistances needed for human action and human advance. And his safety is ensured, his hopes securely founded, not in the spontaneity of an overruling personal attitude bubbling up or spurting out unexpectedly somewhen from somewhere, but in unvarying modes of cosmic action which he can trace to their source, into the knowledge of which he can grow, on the operation of which he can rely. The supreme resource for nations and races, as for individuals, is not some higher being on whom they can shift the responsibility for their folly, but a universe of infinite richness, the origin and support of all they are and do, which delegates to them the power to stand on their own feet and be themselves. Better for us that we should be spared from Nature's partialities, for we escape her dislikes; that we should go on our way unloved, for that relieves us of her hatred; and that we should even have to count with her justice, for that secures to us the priceless blessing of her uneering exactitude. If we could regard Nature as conscious, we should be entitled to say that she cares nothing for man in order that man may care more for himself.

CHAPTER XI

MAN IN HIS "HIGH CONCEIT"

We live in an age that has overtopped all others in its achievements — an age which was well characterized recently by an opinion gathered from experts describing "the seven wonders of the modern world" as the wireless telegraph, the telephone, the aeroplane, radium, antiseptics and antitoxins, spectrum analysis, and the X-ray. But mind is still far from being treated as "the standard of the man," and its efficient application to the problems of the individual and of society continues to be an ideal rather than an accomplishment. It would be enough to point to our maladjustments and wastes in industry, as revealed by the Hoover committee; to mortality and sickness returns now issued so impressively year after year; to our conflicts between labor and capital, our statistics of "poverty and wealth," our annual toll of suicides, and our constantly recurring "crime waves." Yet beyond and beneath these are the shortcomings which furnish each new generation with its feeble-minded and insane, complicate the relations of individuals to each other within their own community, and work to separate into self-centered and clashing groups the nations which should be bound closely together by ties of harmonious coöperation. Much desirable unification has been wrought in the forces that make for human welfare: even the coming of machines, to do for man what he once had to do for himself, has contributed potently to his liberation from the grinding toil of the past. None the less are such benefits tempered by losses, and not the least serious of them is the outcome of that standardizing process which, by working to efface individuality, threatens to slow down, if not to stop altogether, the advances now being made. And man, who has not progressed intellectually since the days of the ancient Greeks, is still the prey of delusions, from belief in the magic of an amulet to reliance on the forecasts of the fortune-teller or the astrological expert.

"What is man that Thou art mindful of him, and the son of man that Thou visitest him?" A recent calculation showed that the total population of the earth could find comfortable standing room in one of the London parks, and that around the whole of humanity thus assembled a bicyclist could make his leisurely way in from three to four hours. If collective man be thus diminutive in relation to his planetary home, what shall be said of individual man as contrasted with the dimensions of a material universe at least 30,000 years wide when measured by the swiftly moving ray of light? Yet it is this same being, lost to the eye at the distance of a few miles, who proudly claims first place in the scheme of Nature. You will remind him in vain that he inhabits one of the smallest parishes of the solar system, and that his day star flames inconspicuously amid the glow of hundreds of millions of suns. His self-importance is not to be diminished by astronomical calculations. As sturdily at home as an ant to which the country lane is a world, or as an amoeba to which the pond is a whole universe, he accepts every natural provision as an acknowledgment of his rank, every chance accommodation of matter and life to his needs as evidence that he was born to rule and is master of all he surveys. It is but a step from the thought of dominion over the earth to the belief that he is favored from the skies. The planet which in so many ways yields to his will — satisfies his appetite, tempts his intellectual curiosity, ministers to his esthetic sense — must have been intended for his occupation and furnished for his comfort. Regarding himself as the final fruition of infinite travail, the object of eternal care, he fearlessly harnesses the cosmic process to the chariot of his own activities and interests. But only while he is intellectually immature. With the coming of extrospection and introspection how unsubstantial grow all these dreams! Man finds his lot cast in a world which has no need of him — discovers that, plume himself as he may on his superiority to "dead" matter, the inanimate is overwhelmingly his master. The comet or the "new star" has power to move him profoundly; he has so little sway over his own environment that the clouds come and go without his let or hindrance, and he is at the mercy of every wind that blows. He counts by millions and billions of years, and an average of seventy winters and summers is all that he may witness. The lower animal which he exterminates in sport often exceeds him in strength, as the bird he shoots for its plumage outdistances him in speed. Aspiring to the heavens, he claims highest place among created things, yet the invisible microbe may pronounce his sentence of death.

To realize how far the human animal was fashioned for primacy we need not, with the result in view, concern ourselves much about the process. In his anatomical structure man is plainly a series of overturns, revisions, makeshifts, not a consciously executed product of art. The quadrupedal bias still lingers in his frame and will not up. In appearance, judged from other than merely human points of view, he might be called hopelessly ugly; even for his kind it is only a curve or two, a few symmetries, the esthetic sense of the beholder, countless connotations of interest, and the blinding effect of long familiarity, that save him from being repulsive. The trunk alone could pass as a shapeless nondescript, but it must be viewed with its outfit of pendulous arms and hinged leg appendages. Plant the human body thus supplemented on the projections we call feet; crown it with the protruding head, half sphere, half cube; face it with duplicate eyes, preposterous nose, ears insufficiently tucked away; and the sight to a being versed in an esthetics more exacting than ours would be insufferable. There is undoubtedly a non-human element in man's ideas of beauty, for these are founded on the esthetics of Nature — on a process supremely lifted above human interests. But all such ideas are fatally complicated with the illusory notion that what is customary with us possesses an absolute rather than a merely relative value. We get a suggestion of this from the extent to which esthetic ideals vary even within the race, and we may find illustrations within our own fashions without going to the Hottentot, the Botocudo, the Samoan or the Malay. Now, if savages, barbarians and semi-civilized peoples may differ from us in their preferences, as well as among themselves, why should not our own anatomical structures, physiognomies and methods of personal adornment find disfavor among them, to say nothing of other beings unlike both, of whom we know nothing, yet whom we are none the less entitled to imagine? Here we come upon the real meaning of the ideals we have inherited from the ancient cultures. For our judgment bases itself, not on anything which is peculiar to individuals, but on physical traits that sum up the general average of the elements which recur most constantly for experience. Beauty in the human form is the highest development of the anatomical and physiognomical characters which our race has had perpetually before its eyes since the beginnings of civilized life; it is in the presence of such characters, lifted to their completest expression, that the esthetic sense finds its highest gratification. Human ugliness, *per contra,* is largely the ugliness of the unfamiliar. In this field, at least, man has an ineradicable prejudice against innovations, and he tolerates them least of all in the forms which come nearest to him and on which his life interests most intimately depend. If it is the normal which rules our esthetic judgments, the "abnormal" can only excite our disfavor: the very word carries with it this disparaging implication. Under other conditions of development the yellow, the black, or the brown man's ideals of beauty might be ours. If all men were hunchbacks, curvature of the spine would be eminently respectable, and the straight-backed exceptions might encounter popular disapproval. Had evolution taken a different turn, our temples of classic sculpture would offer allurements other than those with which they now attract; we might be admiring the one-eyed Venus, the two-nosed Hebe, the tailed Apollo Belvedere.

How, finally, does man bear himself towards the human community into which he is born? You would think him eager to show his oneness with it, as well as his dependence on it, by a becoming modesty. Yet the more benefits it confers on him the more eager he is to display his superiority to the "averages" around him. Nor is the rank of princes or kings needed to produce this form of self-elevation. An individual may catch from some distant ancestor the knack of looking down from his little eminence on the coarse-grained humanity beneath. The purer blood and finer fiber may come with sounding titles at court — may be obtained through wealth, political power or literary prestige; many a time they have been won by honorary decorations, by flattering memberships, or by coveted degrees. In social dynamics the exalting potency of a uniform, even the transforming influence of a dress suit, must be reckoned with. And in this struggle for uplift what compromises and concessions may not be required! How many intrigues and schemings that somebody may seem better than his fellows! What nicety of social behavior that the "skirts of happy chance" may yield the needed grip! What precision of adjustment to persons and things that favor may be won and disfavor avoided! What strainings after endowed unworthiness, and what holdings-off of unendowed merit! How many fears to take the side of right lest the friendly rebel and the unjust conspire! And what a splendid and whole-souled tolerance of wretchedness and obscurity of every sort! Then, through it all, observe the presumption of special powers to match the assumptions of special merit. A man undertakes to be judge of right and wrong, with all the vast complexities of human action and interaction concealed from him — to be a legislator, often as ignorant of the history as of the psychology of peoples and races — to be a diplomat, usually unversed in the language and literature of the nation to which he is accredited — to be an educator, locked in the traditions of a system, though commissioned to inform and free the mind — to be a scientist, loyal to his specialty, but seriously liable to ignore other specialties — to be a priest, with no more of omniscience regarding spiritual things than those who look to him for guidance. Yet in the throes of the good opinion he has formed of himself, the human's faith in his transcendent powers of "handling" or counseling men never wavers: to hear him in rostrum, pulpit or legislative halls you would sometimes think he embodied the final wisdom and were prepared to put the whole of humanity back into leading-strings. And when observing his daily walk and converse — the mysterious carriage, the self-complacent gravity, the impassive features — you may find the very atmosphere around him redolent of the self-importance which so effectually hides the qualities that should distinguish him as a man.

It is one of our human misfortunes that no higher order of beings is at hand to shed light on our littleness and rebuke us for our presumption. Something of this wisdom from contrast might come from our own planet had the human animal been outdistanced in the race for primacy. Were man vassal to tribes of life more highly organized and intelligent than his own, as the lower animals are vassal to him, the juxtaposition would relegate human kind, even for its own estimate of itself, to a position very much lower than that of the angels. Will the bond which may connect us with a whole hierarchy of such beings ever be discovered? Not even the suggestion of an answer need be hazarded. But the universe is wide, and what can be imagined by man as probable is surely within the resources of the cosmos. With a material universe of suns and systems of suns in sight, every atom and molecule in them linked by likenesses to the substances and processes we know on the earth, there seems ample ground for assuming the existence of forms higher than man, and thus superior to him in ways both conceivable and inconceivable. Among beings that "live" there may be many which carry on the activities of self-maintenance under conditions vastly more favorable than those which limit us. The need of plant life to work up "brute matter" into protoplasm is by no means absolute. There is no necessary dependence of life on particular constituents of atmosphere: that we need oxygen is plainly traceable to the fact that, finding oxygen in the atmosphere, the developing organism utilized it. Farther afield there may take place syntheses of gases other than those present above the earth's surface. Forms of life are conceivable which would be wholly delivered from dependence on atmosphere however constituted. Organisms elsewhere may obtain energy by disintegration of the very atoms of which they are made up, and may find their nutriment in matter which has none of the characters of "food." Some, less bound than we to any cycle of heredity, may enjoy an enormously longer span of existence. With quicker cognitive processes, with their knowledge less interrupted by such breaks in individual existence as ours, possessing a means of communication with each other superior to both voice and vision — at once more perfect than we as organisms, superior in their command of mechanical appliances and their power to utilize the inorganic forces — such beings might be advanced enough to enter upon the larger manipulation of Nature, involving a sort of incipient control of the cosmic forces, just as we on a smaller scale long ago began to pierce peninsulas, tunnel mountains and turn rivers aside. If powers of this kind are being exerted anywhere in the universe we may survive long enough as a race to have them revealed to us at distance by some observable deviation from the inorganic order. Nor are we under compulsion to restrict such possibilities to matter and life — to will, consciousness and knowledge. That we shall exhaust material things, either by our new physical analyses of them or by theories like that of relativity, is a hopeless expectation. Is the cosmos so meager in resources that it can produce only a single type of being and display only a single order of unfolding? Why in the depths of acting may there not be that which is higher than living, and in the profound of being that which is grander than knowing?

It is sometimes needful to consider man at his meanest in order that he may be appreciated at his greatest. The more we view the human organism as a work of art, the keener becomes our sense of its faults; the more we contemplate it as naturally originated — physi-fact, yet also auto-fact; product, yet also producing — the larger grows our admiration. To think of man as consciously planned, wrought out with measure and line, then guided along every mile of his way lest he dash his foot against a stone, is to confound his shortcomings with his merits by reducing both to sheer automatism; to regard him as at least a factor in the molding of his own powers and in the determination of his own destiny is to provide an intelligent and rational basis for credit and a working theory on which responsibility may be portioned out. We rightly resent the crude determinism which sums up our movements in terms of the inorganic. Why should we surrender ourselves to that more terrible determinism which ranks our minds as mere pawns to be pushed and pulled on the chessboard of overruling "psychic forces"? Unless human individuality is to become an illusion, and personality to be turned into a pretence, the scales must fall from our eyes. For the intellect to reconcile itself to man, we must see him dowered by the cosmos with the powers of his own organic nature — limited, yet aided by beings of like nature with himself — and thus toiling his way upward against all lapses of condition and buffetings of chance, with potencies of process and structure that excite our wonder, with sympathies, aspirings, sacrifices, heroisms worthy of our reverence.

CHAPTER XII

THE FACTOR OF ILLUSION

It is reasonable to assume that a world consciously designed to culminate in man would afford ample provision for his mental faculties — that to the highest organism thus planned there would be insured knowledge in all its conceivable accuracy and fullness. And were knowledge a sort of universal power, not determined by the nature of the organism, it would impose itself upon things with the whole cosmos for its material, and would do this independently of all conditions save those presented by the world to be known. Such is indeed the view of the untutored regarding knowledge, nor do the tutored always escape from it. Yet knowledge has little of this scope and none of this universal potency. The only direct acquaintance we can have of external things is sense knowledge of them, and this is in large measure knowledge of the ways in which they reflect light. Granting that contributions are made by all the senses, we remain dependent for our knowledge of objects on how they act on us and how we react upon them, not strictly upon anything they "are" independently of our ways of knowing them. We speak of the light which streams in upon us with every recurring day, and of the color which it so lavishly calls forth from the landscape; of the heat or cold with which yielding atmosphere or resisting object affects us; of the notes of a musical instrument, the murmur of the sea, the rustle of wind-stirred leaves, the crash of thunder; velvety softness of peach, hardness of stone or iron; the bitterness of the aloe or the sweetness of honey. All these qualities as perceived have their objective correlatives in the environment, yet as qualitative sensations none of them are other than states of consciousness within ourselves — terms of our own into which we translate from Nature's original text. Yet for ages men confounded these symbols with the things they symbolize, and humanity in the mass does so to this day.

There is the illusion that things have absolute existence, require no support in either time or space, continue and change as self-sourced rather than as system-sourced. The totality of an object is made up of all the stages of its growth or history, yet in sense impressions we know it only in the stage it has now reached; failing any effective intellectual process, we treat this appearance symbol, rigidly restricted to the present, as if it constituted all the stages that need to be known. The rock is what we see before us; the stalk and flower are the whole plant; the total human being is the individual present at this particular instant. From such an attitude towards things all thought of origins is excluded. We fail to relate the end stage to the preceding stages; we confound the fragment in time with the totality in time. And what this naïve, primitive reliance on the sense symbol compels us to do for the time aspect of things it also compels us to do for their space aspect. For the sense symbol can tell us nothing of the link that binds objects together; all it does is to supply us with the raw material of our acquaintance with the changes they undergo. The real bond of relation between them is hidden through our inability to recognize the fundamental likenesses of objects, for these likenesses can be reached only as we know things not merely in single stages of their existence, but also as totalities in time. The rock comes to be joined with all other forms of matter when we recall its history from beginnings; the stalk and flower connect themselves with all species of plants the moment we can trace their course up from the seed; so by the knowledge of origins and development is the particular human being linked with all other human beings, animals, plants and material things.

It has taken ages of mental growth and discipline to rescue man from the illusion by which, confounding the external object with its sense image, he treats the momentary and spatial aspect of a thing as the thing in its totality. Striving to know bodies not only as they seem, but also as they are — not only as they act on us, but also as they act on one another — the human mind had to build up from the raw material of the sense symbols an inner world of subjective relations corresponding, so far as might be, with the external world of objective relations. The image cognition of the earlier stages of mental activity presented the object as given once for all, as without time content, isolated from all other objects because sufficient unto itself. With growth of the power of attention and recall and wider knowledge of the "properties" of things, the merely object classes were expanded and enriched by the building up of causal classes. The notion of things as isolated gave way to recognition of them as dynamically interrelated and interdependent. In this way there was revealed beneath the world of sense images a realm, not of shine or shadow, of light or darkness, of color, sound or heat, but of magnitudes, and distances, of movements and of processes — a multiplicity of things not self-sourced, but system-sourced, in a Nature of doing rather than of being, of quantity at the heart of quality, of conflict underlying quiescence, of power dominating passivity, of antagonism supporting coöperation.

But the emancipation thus wrought was only for the scientist and thinker, and far from complete even for them. The "average mind" continues in the notion that the properties of an object are possessed by it absolutely, and that it may be known without regard to the knowledge of objects in general, of the system of objects or universe. It is in terms of the sense symbol that most of us continue to think of the individual man, the given human group, the particular nation. We recall an event or remember a process by passing in review the sense impressions it produced in us; it is with combinations of sense elements, representing properties, that we plan appliances and contrive results. The absolute view colors much of our reasoning about objects, persons, institutions, events. In human actions it is usually the will which is the chief illuminator: they submit oftener to the arbitrament of pleasure and pain than to the guidance of knowledge. The end to be reached is rarely that dangled before us by the feelings. It is in these that the bodily functions find their inducements and dissuasives, not in any abstract aim to keep the organism in good health and uninjured. We eat to satisfy appetite; we might eat to insure self-maintenance. Much of the work of provisioning cities, building up local and national industries and perfecting commercial interchange arises as a by-product out of the satisfying of personal and family needs. As bees, by self-adjustment to each other, produce geometrically shaped cells without knowing anything of geometry, and as the rich structure and luxurious forms of language arose, not by social convention, but purely out of the need under which men were of communicating with each other, so political institutions, the forms of property, of marriage, of government, have been ushered in not by anything like conscious aiming at the goal finally reached, but by the striving after some proximate end which disguised the real end. Essential as it may be to coöperation that the individual shall be as far as possible like his society, it is the ease of agreeing with, the difficulty of differing from his fellows, which move him to imitation of them, not any deliberate plan of his for realizing the benefits of the assimilative process. Regulations of every sort, whether of social agreement or of legal enactment, reveal themselves to the intellect as means to harmonious relations, yet they are committed for execution to the machinery of the will. The progressive assimilation of peoples and races to each other goes on without any conscious aiming at the advantages of an enlarged coöperating system: these are secured by each group of traders seeking out new markets for its goods, by each nation pushing its commerce from one foreign community to another and finally to the ends of the earth. Even in the higher forms of human activity, where the end of philanthropic effort, of scientific investigation, or of artistic achievement is kept more or less consciously in sight, the element of immediate gratification is by no means wanting.

Into the illusion of human spontaneity science has made numerous inroads. Less than ever do we regard things as containing within themselves all that is needed to explain them. Yet in the cognitions and judgments of every-day life, with the sense image vivid and the intellectual processes sluggish, we continue to view things, motions, experiences absolutely, as subsisting of themselves, as out of relation to the determining system on which all are dependent, and from which all take the aspect which is fleeting and the aspect which abides. And in our "practical" attitude towards Nature we still cling to the belief that individual lives may be thus independent, that the individual organism need not be considered in relation to its species, and that the human individual is above all entitled to rank as an original source of action and of thought. For the realm of feeling the individual is confidently self-active; the realm of mind brings him none the less rigorously under the domination of that larger individual which we call society. With will only considered, he originates and fashions in both organic and inorganic environment; for the intellectual view, most of the things which make up his personality — his language, his ideas, his very actions — take final rank not as individual, but as social products. Not only is there ignoring of the present: we would fain isolate ourselves from the past to which we owe so much. Within us are powers and processes developed by the whole realm of life, yet we are mostly unconscious of the fact, and usually behave as if we denied the indebtedness. Our supremacy in the hierarchy of life is too well settled for us to be mindful of the lowly organisms out of whose toil and struggle our own physiological structure has emerged; we break loose even from the predecessors of our own kind until the work they wrought for our civilization loses itself in history as a mere tale that is told. When genius appears in our midst, the average millions who have nurtured it grow unpicturesque; when inventions leap full-armed from the brain of the individual, whole centuries of obscure experimenters are forgotten; when a great idea pierces the darkness, it is not for the pioneers who feather the shaft, but only for the bowman, that we have eyes.

Meanwhile any attitude towards life which enhances our estimate of it, whether by diminishing its perplexities or enlarging its satisfactions, is to that extent in the interest and service of self-maintenance. We make the world value largely what we will, and the world becomes tolerable or intolerable accordingly. With assistance we can even think beneficially or injuriously about ourselves. Since La Fontaine's physicians, Tant Mieux and Tant Pis, exerted the power of ill-being and well-being by mere suggestion, optimism has been definitely added to the pharmacopoeia, pessimism lifted to rank as a demiurge of disease. Where the ancients had magic and witchcraft, the moderns practice mind-cure and "malicious animal magnetism." The Middle-Age neuropath sickened and died if you did but prick a wax image of him; the twentieth century man goes home with vitality renewed after you have called the spirits of his dead relatives from the vasty deep. It ought to "pay" to be true to Nature, yet the payment is awarded by human nature, and worldly prosperity comes to be earned far less easily, if at all, by devotion to objectivity than in ministering to the illusions of the multitude.

A vast amount of human advance is promoted by feeling and thinking in common, and in all of it men mistake the end that is near for the end that is remote. The battle cry, the symbolizing flag, the song of one's country, are all means to group unification. Patriotism takes its energy from the common interests of the multitudes which it helps to compact; even the religious emotions, apparently so spontaneous and self-centered, borrow much of their glow from the impelling dynamic of race welfare. Nor are the likenesses which promote co-acting merely of the impulsive order. Almost any social, political or religious view on which everybody can agree may dispense with the objective validity upon which science insists, and claim justification on the ground of its usefulness alone. The fashion may be fantastic, the creed absurd, the ceremony meaningless, yet each takes something of social value from the involved assimilation of opinions and conduct. The interests of human unification have a way of overriding the interests of truth. If great enthusiasms for good have lifted communities by bringing men together, the fanaticisms by which they have been misled were not wholly lost for progress. That demons and angels do not exist cannot be pleaded against the socializing power of a belief in them; and though the unseen world of the savage remains invisible to this day it functions none the less potently in the affairs of the individual and the group, of the nation and the race. That "everybody" thinks and acts in generically like ways may have, often does have, a sufficing reason in the conditions of self-maintenance. But it is the glib repetition, the compliant self-adjustment, not the sufficing reason, which is our practical end.

Suppose now that knowledge were given to us without the retarding limitations imposed by the sense image. We should still be under an illusion which few even suspect. It may be somewhat trite to say that in our immediate acquaintance with Nature we are restricted to organic methods of cognizing objects (than which, by the way, there are no other), and that we are excluded from all direct contact with the external world save that which the "five senses" make possible. The truth lies a good deal deeper than this. The whole of knowing, sense process and intellectual process, take their meaning from the nature of the organism as a self-maintainer. As we shall see more fully later, knowledge is not a solvent for all there may be in the cosmos, but a solvent only of those characters which lend themselves to the interests of life. It arises, like consciousness itself, as an aid to self-maintenance; it is developed and perfected only as it is useful for self-maintenance. As the organs of plants and animals are adaptations to life and its environment only as they serve the ends of life, so the faculty of awareness, from its simplest to its most highly organized stages, has validity only for the relation imposed between the living body and the external world: it cannot be extended as an all-pervading principle to the total cosmos. The ever-widening reach of knowledge, the origin of the remote in the proximate and the less direct in the immediate, the springing of distant prospects out of the necessity of near prospects — all this leads to an inevitable attenuation of the material of our knowing faculty until we touch aspects of it which do not obviously serve self-maintenance.

Yet widely as the blades may extend, they are all connected with the turning-point of the fan, and it is in it that their movement centers. In the illusion regarding knowledge we de-localize or universalize it, instead of viewing it as ancillary to life and limited to vital needs; in the illusion regarding truth we give it absolute meaning and cosmic scope, instead of viewing it as unalienably organic and in that sense as our truth.

Saddest of all for so many is the uncertainty which is in conflict with the illusion of goal in Nature. In human life a certain credit is given to him who completes what he undertakes. Human intelligence moves towards results, and remains unsatisfied until they are compassed. The pack may be shuffled a good many times, but the game is always played to the end. Hence the eager welcome which has been given, even by men who are not poets, to the prospect of a "far-off, divine event" which is to justify, not only human strivings, but the whole cosmic process. The hypothesis is a stimulating one, but its value is not demonstrably dependent upon the certainty of its realization. It fails to explain why, with the "whole creation" working to perfect him, man should still be in a state of human infancy. The likelihood of the divine event coming within the lifetime of our own solar system is remote. Accept the existence of vast stores of radium in the sun, and give to the central orb a lease of existence far beyond the estimates of geologists and astronomers. Imagine the consummation of all the hopes of peace lovers, of all the arrangements needed for world unification, of all that individual and social advance upon which the "paradise on earth" is to be built. The end of solar warmth and light, the final collapse of the solar system, the ultimate shuffling of the cosmic pack for a new deal, would be none the less inevitable. With man's "cloud-capped towers" would go the aeons of toil, and with his "gorgeous palaces" the uncounted ages of aspiration, effort and suffering, all dissolved into a fabric thinner than that of dreams. The very texture of the earth would be teased out into cosmic dust and scattered through the ether. There, from fresh buffetings and incessant conflicts, fresh footholds for life might come forth. But the new link in the endless chain of cycles must close as it began.

Nor can we say that the catastrophic method, banished from geology, does not prevail in other regions of the universe. In them the theologian's eternity has gone without the production of a single race of intelligent beings capable of making themselves known to us: so voiceless are the "quiring orbs," so profound the solitude of the spaces, sunned and unsunned, that now and then we doubt creative omnipotence, and take refuge in the conceit that of all the islands in the ocean of power the earth is the only one that is inhabited. Ultimate extinction as a race is our lot *quand même;* there is no bridge of heredity along which the achievements of one celestial cycle can be passed on to the next. If the essential individual in some way survived the dissolution we call death, the belief in immortality might point to a goal which the merely physical process seems flatly to deny. That we do want our activities and our thought extended beyond this earthly span is unquestionable; the less vegetative we are, the greater is our eagerness for the extension. But the grave, while an open door to speculation, shuts us out from any reliable glimpse of the predicted hereafter. Things of the most trivial import for his life are within the reach of man, from the number of pebbles in a seashore heap to the composition of the new star which flashes out in some remote nebula. The thing of most tremendous import for him — whether he is to continue as a conscious personality after death — is absolutely excluded from the purview of what can properly be called knowledge. If men are immortal in any truer sense than that of the "immortal germ-plasm," we ought to know at least as much about it as we know of the past which existed before we came. If we are not to perish utterly from the universe, we should have been made as sure of the fact as we are certain that the human race, the planet earth and the solar system will continue to exist after we are gone.

The factor of illusion might be sufficiently summed up by the conflict between the intellectual and conative sides of man's nature. The conception of truth, formally under the control of logic, is subtly determined by mental history and personal experience. The deliverances of the "practical reason" are constantly invoked to frown down the reason that is "pure." The clearest mind is often a tangle of inconsistencies. The mathematician is sometimes a mystic, the scientific man sometimes a believer in spirits. "I am a polytheist as poet and artist," said Goethe, "but a pantheist as naturalist, and the one just as decidedly as the other." (Letter to Jacobi, 1813.) Now, if the lofty conception of almighty power to which we have been accustomed include the determination of the possible, there is no sufficing necessity for two attitudes towards the environment, with strife set eternally between them. As the automatisms of instinct need not have been opposed to the voluntary acts of conscious choice, so the promptings of emotion need not have been thwarted or menaced by the deliverances of knowledge. It is almost a commonplace to say that the less consciousness there is in life the easier and surer are the adjustments — that the more consciousness shows itself, the greater become the hesitations, the difficulties, the dilemmas of adaptation. In the realm of instinct, mind and emotion are not easily distinguishable, feeling does not exclude certitude, and there is no practical dividing line between desire and duty. Whoever would realize the conflict which sets off the instinctive attitude from the intelligent attitude has only to contrast the perfect adjustments which obtain within the body of the savage and the imperfect adjustments that perpetuate discord between the societies of both civilized and savage the world over. If instinct and intelligence can be combined at one stage of life, a still higher and more desirable synthesis of them must have been within reach of a power conceived of as omnipotent over possibility. Or if the claim be reduced to that of a mere redetermination of the actual, we get nothing more than a sort of magnified human artifice needing things already given for its material — a Nature which is something for itself, which insists on going its own way and is active in its own right. The intelligence of the process is successfully impugned in the one case, its power limitations are impressively displayed in the other. By no interpretation of physics and by no resort to metaphysics can we weave illusion into the "argument from design," based on the notion of an overruling conscious intelligence resembling our own, without destroying its very fabric.

CHAPTER XIII

DOES "EVOLUTION" EXPLAIN?

The demand for a causal explanation of Nature processes and of change in all its forms is inexpugnable from the mind. It is idle to tell us that one event or condition is habitually preceded or followed by another because they are thus juxtaposed in our experience — idle to suggest with Hume and Comte and their successors that all we need to know about change may be summed up by a classification of it into a series of regularly recurring successions. When the earth intervenes between sun and moon, we want to know something more than that our satellite is habitually darkened, something more than that when flame is applied to gunpowder the contact is regularly accompanied by a sudden evolution of gas, something more than that the presence of certain bacteria in the blood is the invariable concomitant of a particular disease. The habitual juxtapositions, the regularities of occurrence, the sequences of mode must be observed and noted. But these do not suffice. The search for cause, however minimized or denied, is implicit in all scientific investigations; Nature knowledge has been advanced, and our power of predicting phenomena increased, just to the extent that to knowledge of the uniformities of succession we have added a theory of the properties or powers which produce the succession and preserve the uniformities. Beneath the how of every vicissitude there is always a deeper why. Things do not change spontaneously. We require a "reason," a sufficing ground, an impulsion of some sort, capable of satisfying us that the change must take place. If bodies are set in motion or brought to rest, they are pushed or pulled; there is differential stress, with gravitative, electrical, chemical or muscular action at work as a determining force. We may not be able to "explain" the ultimate cause of change, but we must assume one, and our formal descriptions of the sufficing reason, expressed in terms of force, do really constitute explanation in the only sense in which we can use the term.

Now the doctrine of evolution is essentially a doctrine about changes. Opposing the old view of creation "all of a piece," whether out of nothing or out of something, and the equally untenable view of sudden metamorphoses, it teaches that objects were not always as we see them to-day, but that they have assumed their present shapes and configurations by a process of gradual transformation, and that the vicissitude to which they are subject is still going on. Yet it is far more content to sum up the order of the changes than to offer an account of their producing determinations: it deals, in fact, with formal successions rather than with causal successions — tells us the how of vicissitude without feeling called upon to set forth its why. Fruitful as a formula, the doctrine has been successfully applied to the whole range of the phenomena accessible to us. But the very universality of the process — the ease with which the evidences of it can be accumulated, and the vivid force with which its concrete examples affect the mind — have led to an exaggerated interpretation of its nature and scope. Evolution is the mode in which material forms emerge or "unfold," yet it has been lifted to the rank of a primary power in the constitution of things. For the popular thought of the time we see it adopted as a key to the solution of all universe problems. Say only that something has been "evolved," and the statement is received as equivalent to an explanation. Even scientific men have sometimes surrendered to the spell of this magic word; and if we would know how completely a merely modal account of Nature can be erected into a causal elucidation of Nature, it is only necessary to recall the recent words of an American astronomer: — "Evolution is nothing more or less than the mainspring of the universe. Grand in its very simplicity, it is the one fundamental fact to which all we know is ancillary. From its influence nothing can escape, for it has fashioned everything, from nebula to man." ("Bulletin of the Society of Arts," March, 1909.)

Now evolution begins in the inorganic with the appearance of matter — born out of some differentiation of the ether which sets free the play of gravitative forces. But science is undecided as to the nature of the process. Half a dozen hypotheses are in the field. The ether is continuous or it is granular; it is a sort of labile foam — its density is greater than that of steel; perhaps there is no ether. The matter unit is a coagulation of ether; it is a knot in ether; it is ether in motion; it is corpuscular — it is electrical. A similar uncertainty prevails regarding many of the details of evolution. What, at the outset, is the relation of motion to the thing which moves? We still treat motion either as an ultimate, which does not need explanation through being uncaused, or as a produced derivative the cause of which remains obscure. If all ether energy is kinetic energy, and the thing that moves is refined away into electricity or some other form of motion, we are left with motions that move — a universe of them — as the source of the solidities we call matter, while matter itself is reduced to types of motion in motion. If ether energy is non-kinetic, we still await an account of how motion arises, and of the relation which must subsist, for the needed unitary view of them, between the energy which is not motion and that which is. If force can be exerted only against resistance, it would be interesting to know why physicists continue to distinguish between motion against resistance, as on the earth's surface, and "motion without resistance," as is alleged in the case of the revolving planets. If there is anywhere in the universe a no-resistance to motion, what becomes of the thesis that action and reaction are equal, and how shall we distinguish between the conditions which initiate change and those which determine no-change? Is conservation of energy limited to the realm of motion, or does it include conservation of mass?

The doctrine of evolution, with a formula that includes retrogression as well as progress, interests us most as a theory of advance, and it is here, if anywhere, that we have a right to be satisfactorily served. The whole realm of matter, inorganic and organic, has been ransacked to show that there is progress from states of disintegration to states of integration, from the homogeneous to the heterogeneous, from simplicity to complexity, from the undifferentiated to the differentiated, from the incoherent to the coherent. Yet the descriptions do not always fit the facts. If sometimes the contrasted processes and conditions exclude each other, at other times they are often manifested in the same aggregate and in the same area. Differentiation frequently appears as means to a larger kind of assimilation; the molecules of any particular type of matter, the units of any particular living tissue — all species, in fact, whether organic or inorganic — are fundamentally systems of likes. The changes which constitute social evolution may begin with differentiation, but the progress is finally from the heterogeneous to the homogeneous. In our modern human societies this aspect of advance dominates all others: everywhere we see peculiar institutional forms, social customs, ways of living, even fashions of dress yielding to an assimilative process which, out of community character and national character, is making world character. As invention runs the older industries of countries into like molds, so commerce assimilates peoples by promoting like needs and supplying like commodities. With the diffusion of dominant ideas in politics, science, art, literature, even religion, the planet is more and more becoming a community of the like-minded. And even language, which perfects itself by discarding the analytic distinctions and cumbrous inflections of its earlier period, thus progressing not from the simple to the complex, but from the complex to the simple, is already preparing to throw off those isolating distinctions which still make the peoples unintelligible to each other. Throughout international life we thus find writ large the process which is constantly going on within the species, the group, the community, the nation — the setting up of those closer relations which lead to assimilation, the likening which is required for coöperation, and the coöperation which in turn gives rise to the larger forms of resemblance and homogeneity.

It seems to be assumed that somehow or other changes are caused, for without determination of some sort matter would be indifferently at rest or in motion. But evolutionary doctrine leaves great gaps in the connections. Its cogs are often out of gear, and its piston has no visible connection with the driving wheel, plain as it is that the machine works. A tremendous breach of continuity is noticeable in its treatment of the change from inorganic to organic. How progress is made from an object which moves only as it is pushed or pulled to a self-moving system which renews itself after waste and reproduces its like remains after centuries of investigation as insoluble a problem for science as that of gravitation itself. Now the organism must arise out of the inorganic as an expansion of characters regnant also there if in a more elementary form; it cannot have been thrust into the world as a new kind of object totally unrelated in its powers and functions to objects in general. Yet the appeals to chemistry and physics, to vitalism and neo-vitalism, to psychism and panpsychism, enforced by researches however praiseworthy, have all failed to explain the transition. We cannot be put off with verbal formulae which merely re-describe the problem they pretend to solve. It is not enough to tell us that organic matter is highly complex, possesses irritability, is capable of reacting to stimuli, assimilating nutriment, and the like. We want to know how these properties emerge from the inorganic. We need to have cleared up for us — in all its connections, with all its pushes and pulls — the power which makes the living units not merely dependent in the dynamic sense, but interdependent in the organic and structural sense; which sets up the demand by each for all, and the insistence of all on each; which works only through the subordination of part to whole, and the domination of part by whole; which, in a word, turns a congeries of molecules primordially indifferent to each other into a society of units system-sourced rather than self-sourced, to impel them one and all towards the self-maintaining activities and configurations that we call life. The analogies which thus relate the individual organism to the species of organisms and finally to human society as a whole must be capable of extension far beyond the limited realm of the living to the sources from which both animate and inanimate derive. But biology is too much concerned with the minute to seek the solvent for its problem in the large. The effort to explain vital characters spends itself mainly in the exploration of the microscopic detail of cell structure. Study of the behavior of the egg-cell after fertilization deals with a secondary process arising out of sex; and Mendelism, frequently mistaken for an explanation of heredity, is no more, if no less, than an account of one of its complications. Supremely untouched by any of these modern conquests of biology is the power of living protoplasm to reproduce its like. Solvents of vital phenomena multiply, but life, the precipitate, remains unanalyzed and mysterious. In the attempt to elucidate the organism from itself, science misses that larger grasp of the nature of life which connects its creative function with the realm of the inorganic and finally with the cosmos.

As the evolutionary view fails to relate vital to prevital characters, so also does it fail to define the inorganic characters out of which heredity emerges as by necessity. Most scientific discussion of vital phenomena takes heredity for granted, as most scientific discussion of the origin of species takes life for granted. In both fields the interest centers in secondary results and in complications of these. Given germ-plasm, what is its relation to the soma or body of the organism? How do the fertilized germ-cells divide, the chromosomes arrange themselves, and the processes of ontogenetic development begin? Why is asexual reproduction succeeded by sexual? Is amphimixis originally an accident, a mere form of nutrition, or a means of providing material for variation? Do body changes pass to the germ-cells, or do the latter vary on their own account? What part do the two sexes play in the inheritance of characters? Are variations minute and gradual or "kaleidoscopic"? What part does natural selection play in organic evolution: is it neo-Darwinism or neo-Lamarckism to which we must pin our faith? In all these matters science is at work, not in the foundations of vital phenomena, but on their superstructure. What we supremely need to know is what goes on in organic matter before it becomes differentiated into germ-plasm and soma, before sex comes in to complicate reproduction, and before the problem of the origin of species is even remotely in sight.

And the secret of all these developments is still securely held by the simplest bit of living protoplasm on which has been conferred, through some natural modification or expansion of the properties of inorganic matter, the capacity for division and regrowth, the ability to differentiate itself into parent and offspring, the power to produce likes of itself. The "dominants" of Reinke, the "determinants" of Weismann, the "engrams" of Semon, have all been called in to explain heredity, but their explanation is verbal only; they apply to cases in which heredity has become complex; or they subsume a physiological memory inseparably implicated with consciousness.

In a yet wider field does this implication of consciousness block our way to the desired solution. The most radical breach of continuity in the doctrine of evolution is its failure to relate what is sometimes called the "intelligence" of the universe to the dynamics of the universe; and here we reach the profounder aspect of its failure to explain life from that which precedes life. It is our habit — imposed on us by our own nature as organisms — to view all appearances of contrivance organically. As our own intelligence is conscious, all other forms of intelligence must be conscious: wherever matter shows adaptation to ends, there we call in consciousness as its directing power. Yet we do this in defiance of the plainest evidence, for growth is completed and intelligent processes go on within us without the slightest let or hindrance from our own conscious states, these being concerned, not with the building up of the organism or with its inner march of events, but with the general activities and mental processes which are needed for relating us to the environment. What we need to have unriddled for us is that power which enables the organism to act intelligently without aid from consciousness by virtue of its very nature as living matter — that order which connects the limited product with its source, the organic with the inorganic, the animate system with the pre-vital cosmos. The world spreads itself out before us as if shot through and through with mind. How are we to explain the bond of common process which everywhere links the purposive adaptations of Nature with the consciously wrought contrivances of man? Why should the universe, like the intellect, segregate and classify, bringing likes together and separating unlikes? What is it that matches the rounded boulder with the sphered planet; that relates the spiral of the nebula and the shell to the volute of the Ionic capital, and these to the curl of the wave as it breaks on the shore; that passes from regularly spaced ether pulses to regularly spaced air waves, sand waves and ocean rollers, to reappear in the iterated lines and patterns of decorative art; that makes one the geometry of the crystal and the geometry of the honeycomb, the intelligence that shapes the dandelion seed to the wind and the intelligence which builds up human industry, navigates the seas and explores the heavens? Of all this the "doctrine of evolution" tells us nothing.

In another way evolution is inadequate. Seen from the natural side, its rationality is unimpeachable. It is the unfolding of power that eternally is into processes and configurations, into motions, structures, shapes. But the moment we attempt to view it as personally originated, maintained, controlled, guided, our difficulties begin. For human intelligence — the only kind of intelligence we know — a plan is formulated complete, and the fashioning follows the plan. There may be discardings and re-buildings as knowledge accumulates, and as new natural properties and methods of utilizing them come to be discovered. But the relation between the mind and its end at any instant is immediate, not provisional or advancing. Now while the machine is a system that works only after it is made, the organism is a machine that works while it is in the making. For the human architect or builder a palace comes out in one piece, not as a series of progressive modifications from an original cave dwelling or mud hut. What engineer planning a bridge would begin with a rope, substitute wood, then put in iron, and finally replace the whole with steel if in knowledge and resources he were adequately equipped for his task from the beginning? The "Learn to labor and to wait" needs modification even as a bit of worldly wisdom: to address it to omnipotence is neither logical nor reverent. Yet it is precisely this method of thought and after-thought, of completion and revision, of overturn and re-making to which the evolutionary teleologists refer the whole furnishing of earth and sky. From non-nucleated protoplasm to nucleated, from unicellular to multicellular, from pre-gastrula to ectoderm and entoderm, from invertebrate to vertebrate, and from quadruped to biped, with accompanying changes in modes of reproduction and endless blind-alleys of structure and type, Nature is one long march from the provisional to the incomplete, one long powerlessness to reach its goal by achieving in a stroke what is needed at once and *de toutes pièces*. And as man finds himself fastened to the evolutionary method — not by the choice of his intellect, but by the nature of his body and its relation to the cosmos — so man is compelled, with only rare exceptions that prove the rule, to work out his own welfare by the same alternations of rejection and advance, the same lingering in stages that satisfy until they are outgrown, the same beckoning of goals that promise finality only to recede or vanish when they are at last won. It was evolution that armed our predecessor with a flint when he needed a knife, that imposed a clepsydra on him when he deserved a clock, that put him off with sails when steam power should have been his, that kept the stylus in his hand when the printing press should have been recording and perpetuating his thoughts. Perhaps the acquirement of all these good things had to be gradual? How gradually do missionaries introduce clothes-wearing, modern implements, and other innovations to the savages they teach? If centuries of evolution are needed for peoples to become up-to-date, how are we to explain the sudden transformations in countries like China and Japan? But the "time was not ripe," "The world was not ready." Would the millions who died needlessly from disease have admitted their unreadiness for antisepsis and antitoxins in the days before preventive medicine and sanitary science? Were industrial operatives ripe for the helping hand of the state only with the advent of factory inspection and shorter hours, and women ready to benefit from humane legislation only when the order came to unharness them from the coal-truck and the embruting labor of the mines? What was it that so long remanded the reform of asylum and prison abuses if not the necessity of waiting on evolution? Was serfdom right even in Roman days merely because it had not been denounced? Was war justifiable because its abolition had not yet come within the range of "practical politics"? That which we see in all these human delays is the what is dominating the what ought to be, the deferred right turning present attainment into relative wrong, the deferred justice making actual conditions relatively unjust. And to the retrospect, individual or social, the sense of deprivation can never be wanting. Nobody will ever accept the view that he has lost nothing by having meted out to him to-day that which ought to have been his yesterday.

The evolutionary method in knowledge is open to similar objections. Nothing can well be advanced against gradual acquirement and constant revision as a process required by the order of Nature. But the claim that it has been imposed upon man by an intellect infinitely wiser and more resourceful than his own arouses a demurrer from which no system of apologetics will ever free us. "Truth in the making" by all means if, even in struggle, suffering, tragedy, we must make it for ourselves; but if we are to be led to it through endless doublings and zigzags by a guide who, knowing the straight path, refuses to reveal it to us, the temper of revolt must be ours along every inch of the hard and stony way. Knowledge slowly and adventurously won, satisfaction following curiosity, the strain of quest rewarded with the joy of conquest, a thousand times welcome! But offer it as a gift consciously bestowed on the instalment plan — grudgingly parceled out in bits, like gulps of nourishment fearfully administered to the starving who should have been earlier fed — and the intellect rebels. What men need at all times is not the error tempered by fact, the wrong view to be condoned because it is "workable," the interpretation *faute de mieux,* the theory sure to be outgrown, but "the truth, the whole truth, and nothing but the truth." We do not instruct our youth that the sun goes round the earth, or that our planet is flat, with the remark that, when their minds are ripe for something better, such statements will be supplemented, revised or wholly superseded. What would be thought of a textbook in any branch of knowledge of which each chapter after the first should qualify, refashion, or completely reverse the teaching of that which preceded it, and of which the closing chapter should form the introduction to a new series of affirmations and denials? The earth is the center of the universe, and all bodies are subservient to it — the universe has no center, and our planetary habitation is a moving mote in the star-spangled cosmos. The energies are distinct, gravitative, chemical, electrical, vital — the energies are varieties of one all-inclusive energy. The atom is the indivisible ultimate — the atom is divisible, and the electrons are the ultimates, or the ether unit is the ultimate. Mass is invariable — mass is variable according to speed. There is matter and there is electricity — there is no matter, and everything is electricity. Gravitation takes time to "travel" — gravitation is instantaneous. Heat is a substance — heat is a mode of motion. Light is an emanation from the eye — it is an emanation from objects; it is corpuscular — it is made up of pulses propagated in ether; it is distinct from electricity — it is an electro-magnetic phenomenon. Life is divinely originated — it is due to a vital principle — it is due to the physico-chemical properties of matter. Life is created and species are immutable — life is evolved, and species are mutable. The germ-cells are produced by the organisms in which they appear — they are left-overs from previous generations. Consciousness is the driving-power of life — consciousness is an epiphenomenon or a psycho-physical parallel. Mind is the summated result of separate items of consciousness — mind is the unity which includes and dominates all these items. And so through the whole round of the sciences, from chemistry to psychology and from astronomy to sociology, we confront the same resting in half-knowledge until it is outgrown, the same progress from old error to new error, the same advance from knowledge invalidated to knowledge provisional, the same lure towards finality and the same disappointments. The method of deferred truth is thus no more satisfying than the method of deferred justice. We accept them only as the outcome of a nature of things with which consciousness, will, personality, have had nothing whatever to do. Viewed as the result of plan, they stultify the only conscious intelligence which is known to us and the only mind of which we can ever rationally conceive. Give us the universe for our support, with a relative freedom to work out justice, to achieve truth for ourselves, and the cruel antinomy dissolves before our eyes.

The outcome of our survey is thus fatal to the psychic interpretation of Nature. In the deepest aspect of this view we find it weighted with the determination to see the universe not as all-productive and multi-potential, but as restricted to the development of mass and motion, of interdetermining forces, of bodies spatially limited and subject to causal action, of organisms that maintain themselves and require knowledge for self-maintenance. And within this aspect, concerning us more nearly, and on that account all the more misleading, is our tendency to assimilate the cosmos yet further to ourselves by reading into it the characters of vitality, will, consciousness, mind — by linking it to human interests and conceiving of our relation to it in terms of human values and human aspirations.

Now whatever this attitude may do for religion, we cannot regard it as advancing science. We look to science for explanation, and the psychic interpretation does not explain: alike in return to the primitive ensoulment of Nature, or in resort to a supposed elementary vitality in the atoms, it merely adjourns a problem which the very hypothesis admits to be incapable of solution. We might as well try to account for the flower by assuming that stalk and roots are made up of units each of which has something of the flower character, or for water by assuming that it must be composed of molecules and atoms each of which has the "water" property if in a more elementary form. We have here in physics, as once before we had in biology, the hypothesis of preformation where a theory of epigenesis is needed. Neither vitality nor consciousness can be traced to really ultimate units: they imply and require collectivity. And if we expand the doctrine into panpsychism we confront the insuperable difficulty of realizing how psychic characters ancillary to self-maintenance can either arise or function in an inorganic realm which shows neither activities nor structures that can rightly be called organic. Even if consciousness could be envisaged as a kind of universal entity, vaporous, ghost-like or what-not, ready everywhere to invade matter, get a grip on it, and carry it along, as Bergson suggests, " to organization," we should still be left with our puzzle all unriddled: the gap between organic and inorganic would continue to yawn, or would be bridged, not by causal relations, but by formal propositions; the appearances of plan in Nature, the suggestions of design in plant and animal, the plain evidences of intelligent adaptations unconsciously reached throughout the realm of life, would receive a merely verbal, not a real explanation. As by no assumption of an *élan de vie* do we approach even a pretence of accounting for life, so by no assumption of psychical " jets," " spurts," " leaps," " impulses," " upspringings," arising anywhen from anywhere, can we supply the links that are needed to relate the organism to the cosmos.

In seeking extra-organic aid from the *psyche,* whether scaled down to the " electrons " or scaled up to the universe, science is taking a road which — to the defeat of the very method on which its triumphs rest — can only end in a wild subjectivism. It has already accumulated knowledge enough for a provisional view of Nature: all that it now needs is a rational use of the materials accumulated. And the goal to be reached clearly lies in the direction of realizing that the universe is infinitely more for itself than it can ever be for man. We must first of all give up our fatal habit of assuming that the cosmos can be lifted into respectability, as it were, only by projecting into it the local and peculiar characters which we find so valuable to ourselves. Subjectivism in the past has exalted us to a proud superiority over the inorganic things which it has been convenient to sum up as ether and matter, as mass and motion. We have disparaged the world of power about us largely because, impressed by the visible and tangible, we early fell into the mistake of using them as a label for the universe in its totality. A cosmos with a vastly richer content, alike of actuality and possibility, now invites our contemplation; and within its unutterable sweep we discern a system which is to become intelligible to us not through our ability to spiritualize it, but through our power to interpret the phenomena it presents in the light, so far as may be, of its own nature, process and modes. The time has come to trace to power itself — to the accessible ground of the energies, forces, bodies, motions which we call cosmos — those appearances of design which, in the psychical interpretation of them, have been subject to age-long acceptance as evidences of "mind in Nature." But to do this we must emancipate intelligence from necessary implication with consciousness, just as we must emancipate power from necessary implication with motion. For what do we mean, what ought we to mean, by intelligence? The subjective element of the conception is usually most emphasized — is altogether emphasized — when the biological sciences are not in question. Yet it is possible to think consciousness wholly away from vital activities without disturbing our idea of their intelligence, while it is impossible to mentally abstract the activities themselves and conceive of intelligence. Even when thrust most vividly upon our attention, consciousness appears only as an added instrumentality, not as a constitutive principle. To realize how little we are entitled to look for it in the inorganic world, we have only to remember that it is not needed for the vital processes within our own bodies, and shades off to a vanishing point in plant life. Why, then, in the realm of the inorganic, should we still find "intelligent adaptations"? The answer can only be that intelligence is not primarily conscious, but primarily dynamic; that the process which we have so long tried to interpret psychically is rooted in the very modes of motion to which power gives rise; that we are in fact dealing with a universe which, strange as the paradox may seem, is "intelligent" before it can be conscious, and "purposive" before it can develop the faculties of mind.

Accept this deliverance from the psychism which, after capturing metaphysics, now threatens science, and our most serious difficulties regarding organic evolution disappear. The self-maintenance we call life links up with the more elementary form of self-maintenance which we know as the conservation of mass and the conservation of energy. Intelligent action by the organism in relation to environment, shown especially in the invention, fabrication and utilization of tools and machines, connects just as naturally with the unconscious artifice by which the living body develops organs within itself; so both relate themselves to their source in that vaster cosmic intelligence whose ordered configurations in the pre-vital realm appealed to the older teleologists as "evidences of design." For like reasons the account of organic progress as due to a "survival of the fittest" subordinates itself to an account of the origin of the fittest; chance in both organic and inorganic gives way to direction, the purposive is seen everywhere dominating the mechanical, and the real evolution comes into view.

PART II

PURPOSIVENESS IN GENERAL

CHAPTER XIV

PRINCIPLES OF NATURE INTERPRETATION

The relational view emphasizes three principles which should guide in all efforts to interpret Nature. They may be formulated as: 1. The Principle of Likeness. Objects which, however they may differ in superficial characters, resemble each other in fundamental characters, belong to the same system, and must be interpreted in the same way. 2. The Principle of Derivation. Wherever in local, superficial, transitory aspects of Nature we find characters that demand explanation, we are bound to seek that explanation not primarily in other local, superficial, transitory aspects of existence, however necessary knowledge of these may be, but primarily in its fundamental and universal characters. 3. The Principle of Universality. True explanations of Nature cannot be isolated explanations, explanations *sui generis,* explanations *ad rem,* but must be explanations which are themselves interrelated. In other words, all great laws which are to formulate or describe Nature processes must be laws that are primordially valid for the universal, the fundamental, the permanent characters of the cosmic process, before being derivatively valid for its local, superficial, and transitory characters. The explanatory range of every true natural law, that is to say, must resemble, to use a homely illustration, the range of a through train which reaches the subsidiary, suburban, outlying stations only because it has begun its trip in the great metropolis.

All three principles assume and demand the thought of the all-inclusive unity of the cosmos. The first, aimed at the failure to realize cosmic unity, preserves us from separating in our thought great classes of phenomena that belong together; the second saves us from the temptation, so strongly held out by sense knowledge and our local position in the universe, to reverse true principles of interpretation by employing the local and immediate for the elucidation of the permanent and the universal; the third emphasizes the orderly filiation of all explanations of Nature phenomena by referring such phenomena to their ultimate source in the ether system. Accepting all three, as we are compelled to do, then it follows — from the principle of likeness, that matter and ether, being connected by action and reaction, are of fundamentally the same kind — from the principle of derivation, that we must finally interpret the mind by the body, and not the body by the mind; the individual by society, and not society by the individual; the cell by the organism, not the organism by the cell; the organic by the inorganic, and not the inorganic by the organic; matter by ether, not ether by matter; the unit by the universe, not the universe by the unit — from the principle of universality, that whatever explanations are reached for vital, for chemical, for electro-magnetic, for gravitative phenomena, must be interrelated explanations, and that the causal determinations which result in organic activity and structure cannot be other than derivative forms of the causal determinations out of which inorganic activities and structures arise.

Many theoretical insufficiencies may be traced to neglect of relational principles. The physicist, by ignoring that of likeness, need not assume that there is any relation other than an adventitious one between matter and ether; while, by denying derivation, he may even seek to explain ether from matter — the universal from the merely local element, with the result of one or other of the familiar comparisons in which physicists liken ether to jelly, wax, or steel. Well-nigh all the difficulties thus far met with by the human mind in trying to realize the nature of ether have been difficulties resulting from the effort to approximate it to the nature of matter. Le Sage used material corpuscles to elucidate gravitative action; Newton's theory of light had an analogous basis in matter; heat was long traced to material elements which could be mingled with and obtained from the molecules of objects; the early "fluid" hypothesis of electricity anticipated, in its material character, certain modern methods of accounting for the luminous manifestations of electro-magnetic phenomena; it is still, in our own time, found possible to formulate hypotheses for the ether which contradict those held for matter. We have as yet reached no unification of the power which an object puts forth as moving with the power which the same object possesses and exerts by virtue of its relation to all other objects. Meanwhile the principle of derivation has been ignored in the effort to make all power kinetic by deducing it from an original motion "property" instead of from the power system. An inevitable result of the view which regards the unit object as possessing its properties absolutely, and finds no constitutive necessity for relation between matter and the ether, is the absolute attitude towards the method of the so-called "conservation of energy": by treating expenditure and conservation as separate processes either of which might theoretically exist without the other it regards the relation between them as adventitious. In the relational view they are constitutively related, since they reciprocally interinvolve each other as aspects of the two-sided unity which we call Power.

Observe now some of the results which the absolute attitude towards "conservation" makes inevitable. If "conservation of energy" is a character possessed absolutely, not contingently, by matter, then it is useless to seek the explanation of it in any process outside the realm of matter. If, again, the power with which an object moves is something *sui generis* — not related either to the nature of the object or to the power system — it is equally useless to seek for any relation between the "conservation" of the energy of motion and the "conservation of mass" (the so-called "indestructibility of matter"). And if, finally, the conservation of the organism is in like manner something absolute, instead of contingent, there need be no inquiry as to an origin for it in earlier and more universal forms of conservation. It is, in fact, by failing to relate to each other the various forms of conservation — conservation of the ether, conservation of motion, conservation of the organism — that science abandons all hope of the solutions held out by the application of relational principles.

The emphasis which has been placed upon the principle of evolution is itself not unconnected with absolutism in Nature study. That the doctrine of evolution, so-called, should have formed the first great step towards the completion of Nature knowledge becomes explicable only when regard is had to the fact that the relations earliest revealed to the mind are always those of change. As the "time" aspects of objects are aspects of difference; as it is the procession of an object from one stage of its existence to another and not its continuing existence, which most excites our attention — it was inevitable that when the human mind began to reach out for the deeper and wider acquaintance with objects which is to be gained only from a knowledge of their connection with each other, it should have been overwhelmingly impressed, not with the fact of their relation in "space," but with the phenomena of their relation in "time." And if it be asked why the mind has simultaneously fallen short in the equally necessary process of realizing objects as totalities in their extension aspect, the reply is that the field is here not one of differences that shock the consciousness because they embody change, but of resemblances cognizable by the intellect rather than by the senses — that the deeper extension aspects of existence, being aspects of the fundamental, the universal, the permanent, manifest themselves, not as differences, but as likenesses, and, long resisting the solvent of the sense knowledge, yield only to the intellectual process, thus coming late into Nature knowledge as one of its most mature and advanced stages. The result of this failure to complete our succession or "evolutionary" knowledge of objects with an equally radical insight into the extension aspect of Nature has been, so far as the fundamental method of its thought is concerned, to retain science in a stage which has advanced little beyond that represented by the mind of primitive man. There is undoubted recognition of the fact that objects are interrelated by action, yet the action is viewed independently of the nature of the objects which act. Alike in regard to their motion and nature, material ultimates are regarded, not as contingent, but as absolute existences — not as system-sourced, but as self-sourced — not as constitutively, but as adventitiously related. And in the view that each object possesses its powers independently of all other objects, the search for cause, which has done so much for the advance of Nature knowledge, dwindles into a mere quest after the relation between states of consciousness until the organism comes to be regarded as in no way necessarily dependent for such states upon any real, upon any actual universe conceived of as existing outside.

Concentration of mind, moreover, on the evolutionary aspect of existence leads inevitably to the narrowing of causes to the time stages of objects — to the substitution of the merely directive incidents of cause for the cause in its totality. Note the resultant tendency to trace particular organs, institutions, processes, to chance incidents of genetic development, as if without those incidents no such processes, institutions or organs could possibly have appeared. In the absolute view, for example, language came into existence not because its development was inevitable, as a means to maintenance, but because of the existence of sounds in Nature that could be imitated, or because ejaculatory cries in man favored its production. So religion has been traced, not to the total organic process which compelled its development, but to some merely directive causal circumstance without the action of which there could have been no religion. Man wondered at his own shadow, pondered over the mysterious phenomenon of sleep, grew bewildered and speculative in the presence of death: hence the thought of soul, the imagining of spirits, the belief in another life. Through the fact, again, of the reverence for parents, of the worship of ancestors, man came to the belief in Deity, to the worship of God. For the absolute view, that is to say, there would have been no religion and no worship had it not been for the shadow, the sleep, and the ancestor; a result which is inevitable, in whatever way a fortuitous incident may determine it to appear, is in the narrow evolutionist, and therefore absolute view, referred to that incident as its exclusive cause.

The neglect to recognize constitutive relation is also seen in our modern attitude towards the organism, which has long been viewed absolutely — viewed rather as imposed upon Nature, with powers possessed independently of Nature, than as arising out of Nature with such powers contingently originated. Hence the effort to explain the organism from the cell rather than the cell from the organism — an effort obviously founded on the belief, however tacitly held, that the cells are not constitutively, but only adventitiously related; that they form an aggregated multiplicity, not a divisionalized unity. This attitude is manifest in the perpetual striving of biological experts to find in some detail of cell structure the "secret of life"; in the belief, which confounds the concomitants of phenomena with their causes, that life is to be traced to some electrical, fermentive or other local process in the organism. We are here reminded of the slow advance which has been made towards relational views since the time when the organs of body and mind were treated by physicians as if each existed and possessed its powers more or less independently of the rest; when specialists expert in one field of human pathology were not expected to know anything of the other fields; when sociology, essentially a science of human relations, was not yet born, and it was the custom to regard the characters of the human being as individually intelligible, instead of as being explicable only in the light of the society of individuals. As early hypotheses regarding man left out of consideration the world of the lower organic life, in the supposition that he was self-sourced, instead of system-sourced, so theorists in the realm of human society took that absolute view of the individual human being from which the exaggerated individualism of the eighteenth and nineteenth centuries had its birth. Even to-day our science of sociology still treats the human individual as related more or less adventitiously instead of constitutively to the sum of individuals, the biological idea, itself absolute, of a system of coöperating units, each complete in itself, having been incorporated almost bodily into the scientific conception of the social system.

Note further how the absolute view has retarded our knowledge of the process of organic development. In the theory of "natural selection" we have an explanation contrived for organisms which has no application to anorgana — a law which, being *ad rem,* describes no part of that higher, that more universal process in which organic development must have originated. And it is because of this isolation of the special theory from any more general theory that we have been compelled to ignore the problem of the manner in which variations arise in the attention which we give to the manner in which they are accumulated — to believe, in a word, that we can solve the problem of the "origin of species" without having first solved the problem of the origin of life. Instead of seeking in the world of the inorganic for some fundamental process of which the superficial organic process is merely a highly special and derivative form, we have been trying to explain the organism by dealing with it alone — by treating it as an object *sui generis,* totally unrelated, or related only adventitiously, to the general system of objects which we call Nature.

It is also in the very temper of the absolute view that we have dealt with the problem of intelligence. The principle of derivation requires us to explain the conscious from the unconscious forms of intelligence, yet we have never succeeded in ridding ourselves of the notion that some form of conscious intelligence, if not our own, is at work in the countless adaptations of structure and process which we find within the bodies of plants and animals. In like manner, the principle of derivation demands reference of the general intelligence of the organism, conscious as well as unconscious, to that larger world in which it must have had its origin; yet instead of tracing organic intelligence to the inorganic cosmos, where the fundamental characters of that intelligence are plainly manifest, we try to read into the universe the most local, the most special, the most transitory forms of intelligent activity — those associated with consciousness. For scientific purposes, that is to say, we seek to explain the intelligence of the organism by making the atoms of matter intelligent; for general purposes, we try to understand Nature by referring its intelligent adaptations to a divine intelligence patterned after the intelligence of man.

The contrast thus shown between absolute and relational views may be traced, with simultaneous disclosure of the source of inaccuracy in the former, through every department of human knowledge. Everywhere the absolute method is the method of ignoring the dependence of the individual object, the single process, on the sum of processes, the system of objects; the relational view is everywhere the method of viewing objects and processes in the light of the totality of processes and objects. Advance in Nature knowledge, however disguised and delayed, has ever been advance from absolute to relational ways of viewing Nature; it has always meant progress from the thought of the object as self-sourced to the thought of it as system-sourced; it has never been anything other than the progressive mastery, by recognition of fundamental likeness, of those relations of stress and restress, of action and re-action, which make up the total system of power which we call universe. Nor is the contrast between absolute and relational merely a character of mental processes: it has its foundation and source in the world of objects. The whole of so-called development, alike in inorganic and organic, is more or less a gradual setting up of relation between units and groups — a growing dependence of each unit on the sum of units, — a gradual increase of the contribution made by unit to group, by group to unit — a progressive subordination of unit to system — an advancing domination of unit by system. The formation of matter groups by the gravitational and chemical processes is simply the earlier form of the process seen on its most complex scale in the organism and in human society. In all the movements with which sociology deals — movements industrial, political, philanthropic, religious — life shows itself as a moving away from conditions that are absolute towards conditions that are relational. As all failures of Nature knowledge have been failures of the absolute view, so all failures in conduct, individual and national, have resulted from an inadequate sense of relation — from the effort to substitute for system-sourced conduct the conduct which is sourced in self. Movement away from the view of the individual and the group as self-dependent towards the view of both as contingent upon and dominated by the system — this is the process which has been at the heart of all moral advance.

It is now proposed to rationalize, and therefore to universalize the procedure which has thus far been followed in the investigation of Nature — to make application to the cosmos as a whole the method which has hitherto been applied only locally and fragmentarily, and has thus been applied with inadequate realization of its universal meaning and scope. In the relational view, the solving of Nature problems yet unsolved is nothing less than a process of reaching out from the individual object, the individual process, to the system which is to elucidate both — a passing from the local and superficial characters which most easily affect the senses to those fundamental and universal characters which appeal to the intellect — a process of universalization which, demanding fundamental likeness as the condition of its possibility, implies a universe of one kind throughout whose units, everywhere system-contributing and system-determined, exist only as they are constitutively interdependent.

Reasserting, therefore, the supremacy of the total mind process over the deliverances of the senses, as well as over every imperfect application of the intellect to those deliverances, the relational view demands that our knowledge of Nature, instead of being made up of unrelated or imperfectly related views, shall have its foundation in an outlook over the whole field. Holding that the warrant for any view of Nature must always be the reasonableness of that view — its consistency with all other attainable truths, with all other propositions believed to be true — it casts the light of the relational method over the path hitherto traversed by the mind. It indicates the way yet to be followed; it points also the goal to be reached. Its task is that of completing the unitary account of Nature, and of doing this by revealing that cosmic oneness which the accumulated facts of science, when relationally interpreted, already disclose. So far as concrete Nature problems are concerned, the aim of the relational philosophy is to unify the self-maintaining organism with the self-maintaining universe; to revise the theory of natural selection with such an account of the internal factors of organic development as shall separate the process by which intelligent adaptations are accumulated from the process by which they are originated; to universalize so-called "intelligence" by showing it to be primarily neither a conscious nor even an organic process, but a process rooted in the very nature of power; and finally, without danger of "pantheistic absorption" or injury to moral interests, to derive all organic and inorganic characters — characters of form, characters of motion, characters of mind — from their fountain and source, the power system, the Purposive Universe.

CHAPTER XV

KNOWLEDGE AND NATURE

Recognition of the truth that at their deepest things form an interrelated, interdetermining whole underlies all working and workable knowledge of them. We realize this when we realize that a name or proposition standing absolutely alone would be meaningless. Subtly or obviously every term we use acquires intelligible significance by virtue of the mental process which relates it to other terms, like and unlike. It attains to completeness as a concept only through the contrasts and resemblances which connect it with other concepts — must be a like for its class and an unlike for other classes: thus the definiteness of our idea of "house" depends on the simultaneous affirmation and negation yielded by such related yet slightly differing conceptions as "tent," "hut," "shed," "shop," "palace," "castle," etc. There are similar links of resemblance and difference between the classes themselves, and such links connect propositions, statements of principle and formulations of natural law.

As already shown, the object we cognize through sense impressions at some particular moment is not the whole object: it can be fully known only as a time-and-space whole, only as linked up with its own past in time and with other objects in space. By this it is not meant that everything which can be known about everything is needed for a knowledge of anything, nor yet that all which can be known about any particular thing is needed for knowledge of it. We do not need to be acquainted with some particular tree in Van Diemen's Land to know the tree we pass daily in our walks — to know all about "plant growth" in Mars to be able to comprehend vegetation in our own world. But there are some truths, some "facts," common to many things, common indeed to all things, which are requisite for our knowledge of particular things, and if these are to be known with the utmost attainable completeness we must reach out in both space and time for adequate grasp of their real nature as wholes. A savage has the power of recognizing and naming a vast number of natural objects, living and inanimate; compare that elementary acquaintance with the knowledge of the expert in natural history, who is also something of a physicist, a chemist and a biologist. Compare a layman's ability to recognize a bit of matter as chalk by reason of its whiteness, softness, friability, with the knowledge of chalk possessed by the mineralogist who knows chalk in its relation to all other substances, and is above all acquainted with the process out of which chalk came into being. Think of the villager who, though keenly alive to every detail of his environment, does not yet know even that the earth turns on its axis, then of the astronomer in whose vision of sun, planet and star is implicit the whole lore of the heavens.

How "facts" are needed to recruit each other gets a simple illustration from the story of man's progress in his knowledge of the earth. That this object was flat all the evidence of common sense, all the testimony which depended for its validity on momentary and local impressions showed beyond a doubt. The surfaces presented to observers everywhere being flat, what could men be living on other than a flat object? And that sense of flatness determined many other deliverances of the human mind regarding its physical environment.

The notion that the earth was a plane not only retarded the advent of a true theory of the planets — it kept alive the belief in an absolute direction of "up" and "down," as well as the notion of an absolute antithesis between "below" and "above"; along with which went not only the ancient thought of Tartarus and the over-world — the Platonian world of sense and the world of ideas — but also the more modern thought of "heaven," and the still lingering view which makes vast spiritual interests depend on the difference between this world and "the other." If the world was flat and central it must be fixed; if the geocentric hypothesis were true, then the Ptolemaic hypothesis of the revolving heavens could not be evaded; and as that hypothesis implied the subordination of the material universe to the abode of human beings, it naturally signified that the whole process of creation from star to blade of grass had been carried out solely with a view to the comfort and enjoyment of man. The knowledge needed was that of larger surfaces of the earth than those which had led it to be regarded as a plane — especially continuous observations of earth and sky by men who should travel over extended areas of our planet's periphery. These came in completest fashion with the circumnavigation of the earth by Magellan's ship, the Victoria: it was the knowledge of many surfaces of our globe, continuously seen from a vessel in motion, sky aspects recruiting land aspects, which thenceforth consisted the dominating body of deliverances on the subject; it was the interpretative power of these deliverances which for ever established the view of the earth's rotundity against the view of it as a plane. Alone, the appearances presented by small areas had failed to yield accurate knowledge of our planet's shape; recruited, illuminated and completed by the appearances of many areas observed in continuity, such original deliverances acquired their true meaning.

Like illustrations hold good of the manner in which the race reached its insight into the solidarity of individual man with all human, with all animal and finally with all organic forms whatsoever. We get a glimpse from ancient history of this process in the period when men who could not be understood were regarded as barbarians. It was the contact with many peoples, with their habits, customs and thoughts, which made the campaign of Alexander so fruitful a means of advancing the conception of human unity throughout the ancient world; it was the work thus begun by the Greeks which blossomed forth into the saying of the Roman who regarded nothing human as alien to him. Nor was the advance merely secular, since it was the same growing sense of the oneness of the race which, by widening the domain from which impulses came to the individual from the sum of individuals, helped to bring in that movement of social re-birth which we call Christianity. Yet the knowledge of different varieties of man in the present — so susceptible of enlargement even in modern times that the single visit of the tourist to some foreign country illuminates it anew — needed enriching with knowledge of man in the past. And as the human story is indissolubly bound up with the story of all organic forms, plant as well as animal; as life, whatever its rank, has a time as well as a space aspect, the student of our kind finds himself gathering knowledge from the whole field of vital phenomena, with all their evolutionary aspects taken into account — from biology buttressed in physics and chemistry, from physiology and anatomy buttressed in palaeontology, geology and geography, and from such culminating divisions of knowledge as anthropology, ethnology, ethnography, history and literature.

Man's comprehension of Nature begins with the knowledge of immediate and local characters; it advances by extension from those characters to objects and areas farther afield by a process of universalization. But as the cosmos, being a unity, cannot be accurately known in sections, each treated as if it were unrelated to the rest, universalization depends for its value on whether fundamental or only superficial characters are thus extended from the particular area to all areas — from the individual object to all objects. When the profounder characters of things are thus dealt with, the inference from local to universal finds its justification in the utility of the extended knowledge; when the characters universalized are the superficial, the local, the merely sense characters, the extension shows itself to be misleading and comes finally to be invalidated by the larger movement of Nature knowledge. Of the incorrect form of universalization the projection of life and consciousness into inorganic nature may serve as an example; the correct use of the process is seen in the extension of gravitation from the earth to the planetary spaces. The two processes really recruit and supplement each other, for while on the one hand we depend immediately on local objects to help us to the knowing of objects farther afield, on the other it is what we must think regarding all objects which in the end determines our deepest thought regarding any particular individual object. As general or fundamental characters must be represented in local characters, so local and immediate characters must as derivatives have primordial representation in universal characters; and it is the use of the local in the discovery of the universal, the use of the universal in the modification, enlargement and enrichment of the local, which are the soul of all progress in Nature knowledge.

All this implies advance in the setting up of links between things — a passing from the view of them as unrelated to the view of them as related. Man begins by regarding objects as independent of each other, as subsisting of their own right: this occurs even for only slightly differing members of the same class, such as individual trees, quadrupeds, men; the gulf grows wider between plants and animals; it seems widest of all between things inanimate and things alive. Knowledge in all these fields increases in the degree to which we pass from acquaintance with things as existing in the here and now to acquaintance with them as time-and-space wholes — as linked up with the past of their individual history and with their connections in space. In Nature study the unit cannot dispense with the system. Holding the simpler, the more superficial truths, with a growing sense of their inadequacy, man has pressed forward towards the additional facts needed to complete them, impelled by a consciousness of inadequacy not altogether unlike the physical hunger which impels the organism to the self-completing activities of nourishment and growth. And in this process, for the scientific mind at least, the separations so long maintained between individual objects have passed away, the gaps between many classes of objects have been closed up: to a considerable degree there has been coalescence of the material accessible to knowledge into a body of interrelated facts. Nature knowledge has progressed just to the extent that, substituting the relational for the absolute view of things — the view of them as interdependent for the view of them as independent — it has sought to know processes, areas, objects, not as self-sourced, but as system-sourced. Its advance, from the thought of animate beings as a sum of isolated individuals and classes to the conception of them as interrelated forms of life, buttressed in the world of the inorganic — from the thought of a multiplicity of unlike powers operative in the supposedly separate areas of light, heat, electricity, magnetism, chemical affinity and gravitation, to the conception of a single power whereof these superficially unlike phenomena are simply the aspects — has been throughout, in both detail and implication, advance towards a unitary conception of Nature.

With these examples before us of the need of the universal for the knowledge of the local, of the knowledge of the many for the knowledge of the one, it cannot be maintained that the things known, viewed as time-and-space wholes, have their powers independently of the system which they form — constitute a mere aggregated multiplicity rather than a divisionalized unity. It is not conceivable that, with the rest of the universe annihilated, the atoms would act out their "affinities," that molecules would join themselves together symmetrically to form crystals, that the planets and satellites would continue to revolve around their primaries, that organisms would arise and function in what we know as the phenomena of life. It must be assumed that, as the materials of knowledge are interrelated and interdependent, thus interdependent and interrelated also are the things known — that as the system of knowledge dominates each element thereof, so things, in their ultimates, at least, also belong to a system on which they depend. And this view may be taken without assuming that material configurations anywhere are determined by material configurations everywhere. In the realm of matter and motion there is much discontinuity for the reason that the link between inorganic things is inorganic throughout. The relation of interdependence here set forth is for the ultimates of the power system which we call the ether: it is there, in the constitutive relation which obtains between things, that part most completely contributes to whole and whole most completely dominates part.

We are thus reminded of the single great issue which the discussions of the past twenty years have left un-settled between the absolute and the relational views of Nature. On the one hand there is the subjective view which, based on the thought of things as inert, as unrelated to any total system of power, as containing wholly within themselves such properties as they manifest — based also on a method of interpreting Nature which, while it confuses the appearances of things with the things themselves, also in some measure confounds feelings with knowledge — is logically compelled to regard the universe as incomplete, and as needing to be supplemented. On the other there is the relational, and philosophical view which, accepting the sense elements as its indispensable material, yet laying stress on the intellectual process whereby these elements are utilized in the interest of self-maintenance, bases itself on such a thought of things, conceived of dynamically, that the units which combine in them are recognized not as putting forth their own power in change, but as armed in their properties with the potencies and process of the whole cosmos.

Now the issue between these two views fails of being settled by the final triumph of one of them because science, still hampered with absolute survivals, has not yet been able to complete that objective account of Nature, that relational view of things which, with only an inadequate sense of its scope and implications, it has so long championed. In the long struggle to interpret the cosmos relationally, and therefore rationally, science has closed up many groups of phenomena once set apart from each other in the mind of man, and there has already grown upon it the ambition to federate these groups and finally to unify them. Yet great spaces still remain in the system of Nature knowledge, and until these can be removed the divided areas divided must remain. Let us glance at the gaps that still separate us, not from the principle of unity, for that cannot be shaken, but from that demonstration of real unity which is to present the cosmos accessible to us as a closed, self-sufficient system, containing within itself all that it needs for its own process, and all that we need for the comprehension of that process.

CHAPTER XVI

SOME GAPS IN NATURE KNOWLEDGE

The world cannot be unified merely by pronouncing all varieties of energy to be one, or by showing that the highest types of life have their proximate source in the earliest and lowest of those types. It is the tendency of the absolute view to regard great groups of Nature phenomena as unified when the unifying process has been effective only in bringing together the individual elements within such groups. Thus the doctrine of the conservation of energy has led science to regard the case for Nature unity as practically made up, independently of what may be thought of the relation of ether to so-called "empty space," and of matter to ether. The theory of evolution, again, has been prematurely construed into a description of all the phases of existence, as well as into a solution of all its problems: in the minds of many, Nature unity as a process can be summed up in any plausible formula of cumulative development. So the theory of natural selection, with its wealth of concrete material and impressive appeal to the senses, has succeeded for more than a generation in substituting itself for that deeper contribution to Nature unity which is to proceed only from a theory, not of the origin of species, but of the origin of life.

The demand for a process which shall supplement mere unification within the groups of Nature phenomena, effected through attention to superficial characters, with a linking of the groups themselves on the basis of some universal principle or process common to them all, was never more urgent than it is to-day. The chief obstacles to that completer unification of the Nature world, perpetuating the liability to error and waste of power inseparable from the absolute method, are the gaps which still make science a study of more or less unrelated sections of Nature — the lacunae, for example, between the ether and matter, between constitutive energy and kinetic energy, between the cosmic power system and such inorganic processes as gravitation, and the actions known as chemical and electrical; between vital phenomena and the realm of the inorganic, and therefore between the organism and the universe; between the elementary teleology of the heavenly bodies and the highly complex teleology of the organic system; between the conscious intelligence of the living animal and the unconscious intelligence of its internal processes; finally, between the inner law of the organism's conscious states and the outer law of masses and motions, of action and reaction.

In the first of these gaps — that which either subtly or obviously separates the ether from matter — we are faced with the failure to recognize the universe as a power system, with the ether for its fundamental, matter for its superficial or differential character. For the ether, in spite of Dr. Einstein's unbelief, is still recognized by a number of the physicists, notably by Sir Oliver Lodge, who wrote so late as 1924 (" Atoms and Rays," p. 14): " The spaces between the particles are not really empty. They are full of the medium which holds the particles together, *viz.*, the ether. . . . The planets are welded together into a family by means of gravitation, which again is due to some unknown properties of the ether of space." And the ether, though not directly perceptible to the senses, constitutes by far the vasted area of the universe accessible to us — a realm compared with which the total domain of matter dwindles into insignificance. Yet for centuries matter and material objects have been the only objects recognized as existing: even to this day, in scientific treatises, we continually see the term "universe" applied exclusively to stars, suns and planets, together with the objects on these, and as meaning nothing outside or within them. The time is not yet very remote in which the heavenly bodies were regarded as moving in a vacuum, and when the hypothesis of "action at a distance" was interpreted as signifying action through that vacuum. Important theories, such as those in which Le Sage endeavored to explain gravitation and Newton sought to account for the phenomena of light, depended for their intelligibility on this same supposition of a cosmic emptiness through which material particles could travel unimpeded. We are still within measurable distance of the period in which, while a hypothetical ether had begun to be written about, it was imagined as a medium of more or less vaporous, gaseous, even ghostly character; nor have we yet thoroughly emerged from the temper in which writers on physical science treat the ether as a means of "dissipating energy into space," and apply to it such epithets as "waste heap of the universe." That even in the present day the thought of the ether as a medium for the transmission of light vibrations dominates that of every other property which it may be supposed to possess is shown in statements describing the ether as "the vehicle of communication between the farthest limits of the physical universe," or as "truly the vehicle for the transmission of electrical and magnetic effects as it is for the transmission of light." In no way, perhaps, is the prevailing indecision concerning the ether better exemplified than in the suggestions sometimes ventured on to the effect that it may after all not be endowed with the gravitating property, and in the calculations which are sometimes made as to the speed with which the gravitative power must "travel through space." In 1892 S. Jevons embodied then prevailing views regarding ether in the passage: "It is equally impossible to prove that gravity occupies no time in transmission. La Place, indeed, ascertained that the velocity of the propagation of the influence was at least 50 million times greater than that of light; but it does not really follow that it is instantaneous; and were there any means of detecting the action of one star upon another exceedingly distant star, we might possibly find an appreciable interval occupied in the transmission of the gravitative impulse." ("The Principles of Science," p. 435.) Still later Ernst Haeckel, the naturalist, wrote of the ether: "We have no means of experimentally determining its weight. If it really possesses weight, as is very probable, it must be so slight as to be far below the capacity of our most delicate balance." ("The Riddle of the Universe," p. 228.) Neither of these writers seems to be aware that a theory of gravitation can be valid only when it is in harmony with a valid theory of the relation of matter to the ether, and that to attempt a decision of the narrower question whether the ether gravitates or not in advance of a solution of the deeper and more fundamental problem of why it is that matter gravitates, is to ignore, not only the unity of Nature, but also the interdependence of knowledge.

More specifically is this failure seen in the setting up of a doctrine of the "conservation of energy" for the power of matter in motion which is tacitly denied for the ether, for the matter which moves and for the ether which "vibrates." The indestructibility of matter has long been a tenet of science, and each new textbook reasserts it in language not differing greatly from that of Wilhelm Ostwald: "In all chemical processes the sum of the masses of the material elements engaged remains unchanged." ("*Bei allen chemischen Vorgängen bleibt die Summe der Massen der betheiligten Stoffes unverändert.*" "Grundriss der allgemeinen Chemie.") The doctrine that energy is similarly indestructible came later, and though physicists received with delight the suggestion, first offered by Meyer, that force, as cause of motion, is an indestructible object (“*Die Kraft, als Bewegungsursache, ist ein unzerstörbares Object,*” “Die Mechanik der Wärme”), they failed to recognize that this same doctrine of the conservation of energy is implicit in the Newtonian law which provides for each action an equal and opposite reaction, nor have they done anything to refer to other than local sources in the matter and ether units themselves the energy of the motion which is conserved, beyond perhaps the very doubtful service for Nature knowledge of accepting the merely formal, makeshift view that motion is an ultimate, an original property of matter, and therefore does not need explanation. Yet while the indestructibility of matter and the conservation of energy continue to be treated as if they were different values, there are signs that ere long the resistance with which material objects oppose themselves to the motion of other objects will be regarded as fundamentally identical with the resistance by which the units of both matter and ether oppose themselves to the invasion of their domain by other such units. That some sort of relation is beginning to be perceived between the energy of moving matter and the power of the ether is shown by Herbert Spencer's allusion to what he called the “space-occupying kind of force,” as well as by the tendency among modern physicists to recognize energy, whether as put forth by matter at rest or by matter in motion, as a sort of pressure. If we are to look for the explanation of gravity no longer to a mysterious property of attraction possessed by each unit of matter for itself, but rather to a stress exerted by the ether, we need some rational view of the ether as a power system, and of the manner in which power passes over from that source of it into the form of motion. The modern mind is no longer content with the positivist view that it is only the

" how " which is needed for our explanations of the Nature process.

The conception of cosmic unity demands a theory which shall not only connect matter with the ether, but shall relate living bodies, which are also material systems, to the universe in which they appear and from which they emerge. On the one hand we have a domain in which objects move only to the extent that they are moved from without; on the other we find systems mysteriously endowed with the power of self-movement, as well as provided with organized means of awareness to their environment. The phenomenal differences between organic and inorganic are great, and it is doubtless the influence of these differences which has so long delayed a unitary conception of the two realms. We ourselves move at will; inorganic things not only seem inert — they have to be pushed or pulled into motion. As masses often, and as surfaces always, they are quiescent for us, but they seem such only because the motions which go on within them evade our organs of sense. It must have been this contrast between the self-activity of the organism and the apparent inertness of the environment which brought in modern efforts to explain vitality by reference of it to something outside organic matter — to a " life-current " or to consciousness itself. It was owing to superficial likenesses equally imposing that " occasionalism " was resorted to for the problem of mind and body, and that so masterly a thinker as Kant had to content himself with a practically *à priori* view of the functions of mind. Thus far none have succeeded in winning the " palm of victory " which Von Baer, at the close of his " History of Animal Development," assures us will be won by him for whom it is reserved " to trace the formative powers of the animal body to the universal forces or vital tendencies of the cosmos." Haeckel, in the work already quoted (p. 311), replies to Von Baer's further assurance that " the tree from which the wood is to come for his cradle has not yet begun to grow" by claiming Darwin as the winner. But Darwinism never offered more than an account of the external factors of organic development, nor can anything more be really claimed for his theory. What Darwin and Lamarck did was to presuppose vitality and build upon that. "Give us the organism, the pre-existing life," they said in effect, "and we will show how species came into being." And the two views, though separated by unlike attitudes, have this in common, that they helplessly take for granted the organism which is to vary and the life that is to survive. There is not a suggestion from either that in any attempt to explain organic evolution the world of the inorganic, the more ultimate forms of power, must be taken into account — that in a word some rational theory of the origin of life is the indispensable preliminary to any rational theory of the "origin of species."

What, again, is the relation between such complex forms of intelligence as we find in the organism and those elementary forms of intelligence which impress us in the cosmos at large? The supposition of a stellar teleology has long been rejected by the so-called materialist, yet the curiosity of Malfilâtre is more and more coming to be shared by the student of Nature who, however tacitly or consciously, has taken the relational principles for his guide:

Quelle intelligence secrète
Règle en son cours chaque planète
Par d'imperceptiblcs ressorts?

The sense that there is intelligence at work, if only in elementary forms, among stellar and planetary systems, is irresistible. How under the operation of universal gravitation, which urges objects towards each other, and of a diffusive process that works to keep them apart, millions of such systems should have developed a harmonious cosmic architecture, made up of configurations that display the purposive, the "equalized stress" form, is a problem which only the recognition of an elementary world teleology will ever enable us to solve. The more, grasping the universe process in its totality, we are enabled to use the yield of all the areas of Nature knowledge for the illumination of each of them, the more will it be seen that in the marshaling of the heavenly bodies into teleological configurations we witness a process fundamentally identical in character with the modes of organic activity and of human thought which we call intelligent. For as the ether and matter, which act and react upon each other, cannot be wholly unlike aspects of existence, so there cannot be two totally unlike kinds of intelligence with unlike derivations. And if we must turn to the ether system for the primordial characters of matter, we must seek there also the primordial source of the teleology which is organic.

Nor does the separation thus far maintained between organism and universe result merely in the failure of science, on the one hand to ground its theory of the origin of species firmly on a theory of the origin of life, on the other to trace the conscious and unconscious forms of organic intelligence to elementary and primordial forms of intelligence in the realm of the inorganic. A vast complex of social characters — among them the assimilation of human individuals to their society, and of human groups to one another — still remains causally and derivatively uncoördinated with obviously parallel characters in atoms, molecules and the aggregates of these which make up the domain of matter properly so called. What, again, is the relation of the logical order to the external order in things? Is human thought something *sui generis* — a mere internal activity genetically separated from the world of objects, and dealing arbitrarily with those objects; or is it developmentally related to a process which, giving rise to the organism, also gives rise to mind? Is reasoning a means of self-maintenance peculiar to the organism, or does it emerge from the inorganic into the realm of life? What is the relation of the good, the beautiful, the true, in our subjective experiences, to the cosmos in which we recognize their objective equivalents?

The search for a "universal principle" is not a new quest in Nature study. It was undertaken by the Greeks in that primitive age of speculation wherein Thales posited water, Anaximenes air, and Heraclitus heat or fire as the source of phenomena. In modern times the principle has been formulated in such shapes as the evolutionary process in general, the conservation of energy, the indestructibility of matter or mass and the persistence of force. One advantage claimed for an ultimate principle is that it constitutes a truth of such universal application as to be the law of all objects and areas, the solvent principle of all problems and classes of facts — that it carries the explanatory power of the human mind to the utmost verge of that realm within which things are comprehensible, but beyond whose boundaries the faculties of man droop and fail, like the wings of a bird liberated into a space devoid of air. Once having found such an ultimate, and sure of its objective validity, the mind might proceed to use it in explanation of the less general, and finally of the least general characters of Nature. But the chances of the wrong principle being selected are many. There is the danger of using a "universal" which is applicable to only part of the totality to be elucidated, or which, though possessing the needed generality, has no causal and therefore no explanatory value. The principle of evolution, so called, is certainly a universal, in the sense that it describes a process common to all material objects, yet it is modal rather than causal, lacks explanatory depth, and is otherwise faulty as a characterization of only one side of a universe process which has not only a "time" but also a "space" or extension aspect. The principle of the indestructibility of matter would still lack explanatory significance even if universalized by extension of it to the ether system. So the principle of the conservation of energy, hitherto uncorrelated with the conservation of mass, is of only narrow scope, merely signifying that energy does not pass out of existence. We recognize the "persistence of force" in the case of motion through the action always reappearing in the reaction, or being stored up for future delivery, but we need to know where persistence begins; we need a unitary view of all the examples of persistence — from the universe as a whole, with its numerous subordinate material systems maintained from without, to the organism, with its principle of maintenance within itself. And this view can be reached only by recognizing a universal process through which the cosmos, while originating change through difference, works back to likeness and endurance by arranging its material product into the equalized stress configurations best fitted to endure — forms which are purposive in the dynamic sense just because only in them can change automatically cease and end — the end of maintenance — be reached. Evolution, both inorganic and organic, is the outcome of this purposive process founded in the nature of the universe as a self-maintainer. It is in purposiveness that we shall find the meaning of life, and in life the exemplification of purposiveness. Purposiveness, in a word, as here interpreted, is the key to such comprehension of the cosmos and its creative product as is open to the narrowly delimited faculties of man.

CHAPTER XVII

RECIPROCAL ANTAGONISM IN NATURE

THROUGH centuries of human history the sun was thought to reign alone in the firmament of day, and the night sky to have its stars separated by intervals of empty void. So the plash of the wave on the seashore seemed framed in the stillness brooding over the ocean; the thunderstorm stood out like a brief rage upon the quietness of the heavens; the stir of leaves floated, a disturbing rustle, into the expansive calm of the summer landscape. Things were alone, events isolated, each of them real in its own right; for the link which unites their islands in the great deep had not yet been revealed. A vast period had to elapse before man knew himself as denizen of a continuous universe. Limited by his senses to the perception of "objects," our ancestor regarded these as the only true existences; the intervals between them, apparently unoccupied, he viewed as so much vacuity, the equivalent of nothing. Gradually the voids between things came to be hypostatized into a capacity for containing them, and the "nothing" was erected into an independent entity which men called space. Whence the illusion that space is distinct from objects, and would remain were objects annihilated. Even to-day space continues to function as a vast receptacle for things, a mighty nothing which is the pre-condition of anything, an illimitable is-not that is.

One result of this illusion has been to perpetuate the belief in an "infinite space"; another has been to delay our comprehension of objects as a system of energy to the total power of which all changes within it must be due —

to give us the notion of things existing absolutely, in their own right, rather than as interdependent, bound up with each other, contributing yet subordinated to an all-dominating cosmos. But in these later days we have learned that there are no vacuities, no nothings in the universe. In spite of new hypotheses, science still proceeds, and succeeds, on the assumption that existence is a plenum — that around and within matter there is a continuous ether system without gaps or interstices. Perceived objects and the apparent intervals between them form one unbroken expanse of reality, and it is the extension aspect of this reality, not any containing vacuum which they may be supposed to "fill" or "occupy," that we really mean, or ought to mean, when we talk about space. The space through which bodies are said to move being the extension character of existence in general, it follows that in imagining a possible movement of them through emptiness, or into space supposed to be "outside the universe," we are thinking away the pre-condition of movement — the very extension aspect of things which makes movement conceivable.

A similar revision is needed of our ideas regarding time. The same sense limitations which divided the environment into objects and empty intervals between them separated it into activities and wastes of inactivity. Movement seemed to start up from the things at rest as the bird soars into the air; even moving objects appeared to remain quiescent in their unchanging permanence and solidity. With Nature viewed as a system at rest, diversified here and there by motions, the seemingly inactive ground of things came to be hypostatized into a receptacle or containing vacuum for the changes that were perceptible. Hence the conception of "time," in which events are believed to take place, and which it is believed would still go on were all change to cease. The effect of this view was to favor the idea that the particular changes we perceive occur in their own right, independently of the system of change, and thus to delay recognition of that procession of changes which we have come to know as evolution. Yet the notion of a change vacuum, like that of an existence vacuum, has been utterly dispelled by science. We proceed in these days on the assumption that matter, at any rate, is in incessant change, that the events we perceive are continuous with events that make no impression upon the senses, that particular vicissitudes are linked up with a system of change coextensive with the totality of things. Succession, like extension, is a character of energy, of power, and it is this succession aspect of things, not any containing vacuum which changes may be supposed to take place in, that we really mean, or ought to mean, when we talk about time. The notion of time, then, is our human, subjective way of dealing with the objective fact of succession, just as the notion of space is our way of dealing with the objective fact of extension. And though for convenience' sake we may go on using the words " space " and " time," it should be on the understanding that the only proper use we can make of them is in describing relations within extension on the one hand, and relations within succession on the other.

Realization of the truth that the world of power or cosmos constitutes the space it seems only to occupy assists us to rid ourselves of the belief that space, whether occupied or not, must be endless. The dilemma was well expressed in Bruno's dialogue, " De l'Infinito, Vniuerso, et Mondi ":

> ELPINO: *Come e possibile che l'uniuerso sia infinito?*
> PHILOTHEO: *Come e possibile che l'uniuerso sia finito?*
> ELPINO: *Volete uoi che sia possa dimostrar questa infinitudine?*
> PHILOTHEO: *Volete uoi che si possa dimonstrar questa finitudine?*
> ELPINO: *Che dilatatione e questa?*
> PHILOTHEO: *Che margine e questa?*

How has the idea of infinite space arisen? It can have arisen only because the space with which we have had to deal as a race and as individuals has always been without boundaries. Journey as we might over the earth and into the air and around the sun, we have always found space with other spaces beyond it. The notion of the unendingness of space has thus worked itself into the very fabric of our thought about the external world. The reason we feel sure that were we, in remote cosmic depths or heights, to come to an obstacle we should have to count on a continuance of space beyond that obstacle, rests on no other foundation than that our total experience, gathered among spaces which extended into other spaces, has given us the idea of that continuance. Unable to apply an actual test to the problem, our appeal must be to physical considerations against the naïve metaphysics of the conceiving process, to the reasoning powers against the inadequate deliverances of sense. A universe which constitutes its own space, which makes by existing whatever extension there is, cannot be endless. Were the cosmos "endless," there could be no definite incidences of force, and therefore no definiteness of "property," of motion, or of phenomena, either quantitative or qualitative. If we assume its endlessness while recognizing the perfect definiteness of its parts, we deny that things depend on one another and on the whole which they form; that is to say, we deny the validity of the explanations according to which all science proceeds, and therefore the whole foundation of explanation as applied to Nature.

As it is not objects which we have believed to be endless, but space, their hypostatized extension aspect, so it is not change which we have regarded as infinite, but the time which we have provided as a containing vacuum for changes to occur in. And we have been led into the notion of infinite time not because experience is really behind it, but because all the time intervals known to us as individuals and as race have had other time intervals preceding and following them. The appeal here again must be to something other than sense testimony. If we assume the endlessness of change, of succession — the only time that means anything objectively — we make the reaching of definite stages inconceivable, since evolving is a finite, not an infinite process. The idea of continuous changes projected from an endless past of changes stultifies our knowledge of the merely relative advance which has been achieved up to the present. The important thing for us to realize is that, as space extends only as far as reality, things, objects extend, so time belongs to them only in their character as changing, and cannot be used as valid for aspects of reality that have no process character. If there are periods of change separated by periods without process, time is of the former, not of the latter. There is no "eternity" to function as a containing framework for either change or no-change.

The universe, then, does not occupy — it constitutes; the universe process does not occur in time — it makes time. Enabled to conceive of the cosmos as a closed system — on the one hand as source and driving power of its own activities, on the other as an evolving process beginning somewhere — let us now go on to consider the structure it presents to us, its make-up as reality, with the proviso always in our minds that it is not to be delimited by what can be utilized of it in the interest of life, nor by what can be learned about it in the interest of knowledge. Among the earliest suggestions yielded by our experience of power is that it does not exist *en bloc,* but is made up of aggregates, parts, units. We are able to reduce matter to particles which continue, as they are divided, to shrink in size, not only as far as, but even beyond the limits of ordinary vision, nor does the microscope show any limit to the process of reduction. That the ether also has unit character is more than suggested by the manner in which it reacts from the vibrations of matter: without this capacity of ether for minute action and reaction the electromagnetic disturbance of it which we call light would be unintelligible. The manifest uniformity of ether over immense areas seems to be as indicative of unit structure as anything could well be. That ether and matter are of one kind is a conclusion deducible from the known interactions between the two realms, and we fall into no error of "pseudo-simplicity" by assuming that, whatever "properties" they may have that are inaccessible to us as organisms, we are entitled to recognize their fundamental oneness as power.

In all phenomena presented to us a something which is energy or power must be assumed. We may analyze matter into an electric charge, may speak of electric or magnetic units. Yet electricity is a form of motion, motion implies a something that moves, and the inescapable assumption of the something in motion is a reassertion of the thesis which is supposed to be denied. How, then, are we to envisage power, the substance or body of both ether and matter? Are the units of it simply aggregated, a mere multiplicity of separate existences, or are they reciprocally implicated, at once interdependent and interdetermining? Whenever we exert ourselves to move or modify objects we find that, differ as they may in size, shape or condition, all of them behave in a generically like way: they resist our efforts, and do this not merely in bulk, but also as particles, to whatever extent we may carry our disintegration of them. In the world of material things power is in this way everywhere two-sided — made up of stress and restress, action and reaction. Thrust and resistance imply and involve each other: we cannot exert pressure save to the extent of an equivalent counter-pressure, nor can there be any action of object on object except in the presence of or against a reaction equivalent to the action.

This reciprocity of stress and restress which is the very nature of power as known to us manifests itself throughout Nature in ubiquitous conflict, and is the inner meaning of the saying that strife is the father of things. Linked together by gravitative action, the suns and planets act and react upon each other, irrespective of whether they move through a resisting or a non-resisting medium. There is the same exaction of restress for stress in systems that, to the senses at any rate, do not yield even the faintest suggestion of it. Beneath the seeming quiescence of objects, down to the ultimates of which they are composed, goes on a struggle as intense of its kind as any that shows itself in the realm of visible movement. In the kinetic theory we are accustomed to picture the gas molecule as clashing with its fellows, but there are antagonisms not less real between the units of matter in what is known as its solid state. "There, where one-sided affinities only were first detected," says Mendeleieff, "not only secondary and lateral ones have been found, but even those which are diametrically opposite, yet among these dynamical equilibrium establishes itself, not by excluding one or other of the forces, but by regulating them all. So the chemist finds in the flame and the blast furnace, in the formation of every salt, and with especial clearness in double salts and in the crystallization of solutions, not a fight ending in the victory of one side, as used to be supposed, but the conjunction of forces — the peace of dynamic equilibrium resulting from the action of many forces and affinities."

Antagonism is both minute and massive. Adaptations of every kind, whether unconsciously developed or planned in advance, involve this presence of resistance without which nothing can be done, in the absence of which no end can be reached. Invention is a calculation of antagonisms to be met, construction a balancing and utilization of them. If the wing-beat met with no counter-stress, how could the bird ascend? If the screw had no power of water opposed to it, how could the ocean steamer make its way forward? If the human artificer had no resistance of stiffening clay, of solid granite, of adamantine metal to overcome, what could the potter mold, the stone-mason shape, or the iron-founder bring into existence? Says John Ruskin:

> The blunt head of a common, bluff, undecked seaboat, lying aside in its furrows of beach sand — the sum of navigation is in that. You may magnify it or decorate it as you will: you will not add to the wonder of it. . . . That rude simplicity of bent plank that can breast its way through the death that is in the deep sea has in it the soul of shipping. . . . Then also it is wonderful on account of the greatness of the enemy that it does battle with. To lift dead weight; to overcome length of languid space; to multiply or systematize a given force — this we may see done by the bar, or beam, or wheel, without wonder. But to war with that living fury of waters; to bare its breast, moment after moment, against the unwearied enmity of ocean — the subtle, fitful, implacable smiting of the black waves, provoking each other on endlessly, all the infinite march of the Atlantic rolling on behind them to their help, and still to stroke them back into a wreath of smoke and futile foam, and win its way against them, and keep its charge of life from them — does any other soulless thing do as much as this? ("Harbors of England.")

Beneath planning and invention, moreover, is the organism itself with its countless cells engaged in what Roux calls the "struggle of the parts," with the conflict of the physiological processes superadded, and beyond these the antagonisms which make up the struggle for life. Within the species each individual competes with other individuals for food and place, for light and air, for all the things needed in maintenance, and so is the center, acting and reacting, of numberless stresses and restresses that reach it from the environment. There are the like antagonisms, similarly founded, between the species, for though through a relative interdependence they may aid each other, the assistance is founded on opposition, on the "struggle of all against all," and on the refluence of its stimulus to each. The same war which arrays tribes of plants and animals against each other, whether as devourers or as competitors, does but reappear in the war which has ever gone on between tribes of men and other tribes, between communities and other communities, between nations and nations. Nor does the strife diminish with the gradual passing of militancy. In the social body itself struggles go on for place and power that, in their way, match the combats of wild beasts. There are the oppositions of class against class, sect against sect, school against school — the rivalries of capitalists, and laborists, of merchants, lawyers, legislators and politicians — and between individuals the countless aggressions and resistances born of ignorance, prejudice, jealousy, ambition, avarice and hatred. Antagonism, more or less pronounced, may be noted between family and family, between members of the same family, between the individual and society, as well as between the family and society. Within the individual himself there is a never-ending conflict between the intellect and the will, between the higher and the lower impulses, between the race past and the race present, between the more partial or individual and the more general or social ends. Thus the human society which on the surface seems so placid is beneath that surface a great battle-ground of antagonistic forces which, however their balance may vary from day to day, are never really suspended.

Antagonism is present, again, not merely in hostility, where we look for it, but also in coöperation, from which it is usually banished almost by common consent. The presence of others in the same room, in the same company, in the same group, whether the group be an athletic team or an army, is an antagonism none the less real because it may be refined away by the sense of joint purpose and mutual interests. Behind the clasped hands of the friendliest greeting the subtler collisions of character, experience, opinion, unceasingly emerge; beneath love, as beneath hate, lurks the world conflict that buttresses all human existence. As the thumb must be opposed to the fingers in the act of grasping, so in every junction of men for the ends of maintenance the individual must be in antagonism with his fellows as well as with the whole system of coöperating individuals. As the axe of the woodcutter would be useless, howsoever keen its edge, were there no resistance to meet it — no elementary form of coöperation in the tree itself — so the individual worker in a group could accomplish nothing were not his own exercised function in the division of labor met, defined, and rendered effective by the realized functions of all the other participating units of the coöperating system. As the cell of the living organism finds in the other cells the fulcrum for its own special work, so each coöperating community and nation finds its *pou sto* in the activities of other nations and communities. Nor is antagonism wanting when the units of a system seem to be similarly engaged, since each has some differential character, however slight, if only a character of position, that opposes it to all the rest. A gravitating mass, say of iron, is gravitating as a whole; yet each unit thereof is separately impelled, with the result of separate strains upon it that continually vary its dynamic relation to the units near it and to the system of which it is a part. In an inorganic sense, the bricks and masonry whereby the floors and roof of a building are supported coöperate with each other, yet their function is made possible only by reciprocal stresses — stress of brick against brick, of stone against brick, of iron girder against brick and stone — that oppose each other all through the structure. So men carrying a load, though all appear to be similarly engaged, have unlike relations to the things they bear, and must oppose each other in the very act of coöperating. As the various parts which combine to make up a watch at once hold each other and are held, so the various units of the social system stand in a like antagonistic *teneo et teneor* relation to each other.

There is finally the antagonism which underlies the coöperative aspect of subjective phenomena. The way in which, through reciprocally conflicting presentments, we reach knowledge of reality is especially suggestive. Note its resemblance on a more complex scale to the double vision through which the mind gains its sense of the solidity of objects, and does this by opposing to the appearance obtained from one point of view that yielded by another. With our thought fixed upon a single concept, we may not be paying simultaneous attention to all other concepts of the same class, yet it is really the class which has conferred on them their definite and special meaning: in a sense, any particular concept is that concept seen from the points of view of all the other concepts. So groups of ideas, propositions, principles, define each other by an opposition which, because of its basis in brain activities, is as truly physical as the antagonism between cells and organisms. As we know one language thoroughly, and therefore correctly, only by studying other languages, so we acquire a just estimate of our own people and country only by seeing them from the opposing angles supplied by observations among other peoples and in other countries. A general opinion is a product of the conflict of individual opinion with other opinions and finally with all opinions; a truth in any particular field of knowledge is that which remains after critical antagonism has done its work — that which survives after modification, enlargement, enrichment, by collision with truths in all fields. As organic ascent is inextricably bound up with the rivalries, conflicts and competitions in the realm of life, so theories in science find their completed form only through opposition and struggle: note the antagonism between rival accounts of the shape of the earth, between the Ptolemaic and the Copernican view of the world order, between the nebular and meteoric account of solar and planetary origins, between the corpuscular and the undulatory theory of light, between Galvani's animal and Volta's chemical theory of electricity, between Lamarckism and Darwinism, between the theory which asserts and that which denies the inheritance of acquired characters. Not only is the antagonism which secures advance seen in all departments of scientific, political, industrial and social theory: we find it in rival attitudes towards the universe problem — materialism arrayed against spiritualism, deism and theism combating pantheism, gnosticism opposing agnosticism, idealism hostile to realism, empiricism rejecting rationalism, monism in conflict with dualism.

The conclusion of this series of fact-supported analogies and likenesses is obvious. They cannot spring up suddenly into the realm of matter, life, and knowledge, of themselves, in their own right, spontaneously. The reciprocal antagonisms which we find everywhere in Nature, in the organism, in human society, and in mind — the linking of action with reaction, of stress with restress, manifested in all aspects of change accessible to us — these can arise as derivative only from that which precedes and anticipates them as constitutive. Father of things in a new sense, strife is written large in what we call Nature because it is first written small, but all the more potently, in that which buttresses Nature — in the ether or power units, analyzable into separates, yet reciprocally involved, opposing yet insisting on each other, the one everywhere subordinated, the many everywhere dominating. And here, too, in the ground of the world conflict, begins the earliest form of the "mutual aid" which, however it may modify or temper conflict, never really suspends it. In the foundation of things, where strife is not their product but their very nature, antagonism and coöperation are one. Without the system demanding each individual stress as part of the support of all the stresses, the unit could have no character as power; without the unit — demanded, as it were, in every cosmic area by the nature of the system as made up of all the units — there could be no summation of power, and no reflow of it as driving force behind phenomena. The dynamical need of each ether unit for all the units, the need of all the ether units for each of them, is the elementary anticipation of the need which the organ and the cell have for the whole living system, and of the need which the human individual has for the society of individuals. And it is this primordial thrust of each against all, of all against each, the one required by the many, the many insisting on the one, which makes the universe, so far as we can know it, a system of coöperating antagonisms, the earliest of the democracies.

CHAPTER XVIII

DOMINATION OF THE UNIT BY THE SYSTEM

The earliest beginning of the sense which culminates in religion is the sense of environment — the sense of something external that cannot be evaded, that aids or prevents and may be utilized, but must be reckoned with. It is this environment that leads out to a system of things without which none of the entities we know can be made intelligible to us. To believe that when a tiny portion of nitroglycerine explodes the devastating effect is produced, far below the reach of the ultra-microscope, by particles of matter active in their own right and "on their own initiative," is to put an undue strain on probability. To say that the material ultimates are whirled in electrotonic orbits "of their own accord," and that suns and planets accomplish their vast revolutions by reason of an energy which has its source in them, is to assert the inconceivable. All separate existences, all doings and undoings in which they take part, imply relation to and dependence on a system. There is recognition of that relation when the plant shoots up from the soil for commerce with sun and air, when the making bird wings itself for flight, when the water-breather fits itself for progression with fins and tail, when the land animal makes perfect its own means of locomotion, when man at last, handed and erect, explores the earth, navigates the seas and rises to the clouds. The lowliest organism responds to a wavelet, a breath of wind, or a shadow; the highest organism busies itself with worlds buried in the immensities. From dependence of the organic individual on its society it is only a step to the dependence of human society on the pre-vital realm from which life derives and by which it is buttressed. As a few figures displayed in a bank may produce a country-wide panic; as a war, wherever occurring, sends its economic and political reverberations round the world; so an outburst in the sun sets all the magnetic needles on the earth vibrating. The law according to which things move and come to rest, yield to differential stress and find their goal in conditions of equalized stress, is no law of the unit, but a law rooted in the totality of existence: as the physiological ultimate demands the organism as the condition of its activity and structure, so does the inorganic unit require for its "properties" the total cosmos. Things are not self-sourced, but system-sourced.

If the universe be a plural system, the many must be more than the one, the whole greater than the part, the system more potent than the unit. The dominating force of numbers, in a sense not grasped by the Pythagoreans, underlies all Nature processes. We realize the simplest form of this domination when we admit that the properties of an aggregate are a numerical multiple of the properties of its unit, and that this cumulation is shown not only in the matter of bulk, but also in characters of weight, rigidity and motion. When an aggregate is temporarily or permanently distorted, each unit thereof takes more or less part in the change, and does so because it is under impulsion from the system to enter into new spatial relations with its fellow units; everywhere the unit acquires from the system a power of resistance to impact which it could not have as isolated; it moves farther as member of a collectivity than under the same thrust it could possibly move alone. We are here dealing with neither mystical nor metaphysical values. Take a few hundred wooden balls and distribute them symmetrically in rows over a large field. Observe the ease with which each of these units can be moved from its place. Connect two, four, six or a dozen of the balls by iron rods, and the difficulty of moving any one of them will be proportionately increased. Link all the balls together in the same way, so as to form an interrelated system, and the resistance to push or pull offered by each will be found insuperable. Think the earth away, increase the balls indefinitely, imagine the rods to relate them not in one, but in all directions, and we have a rude model of the ether system itself, the difference being that in the one case the power of resistance or inertia is derivative, while in the other it is primordial. Unconnected with the rest, each unit yields easily; linked up with all the units, it resists not with its own power alone, but with the total power of the system. The numerical inferiority of the one to the many thus results in the subordination of the unit to the sum of units; so the numerical superiority of the many over the one takes effect as a domination of the unit by the system. And out of this plurality and this interdependence, this contribution and this cumulation, this subordination and this domination, there plainly emerges a function of maintenance — maintenance, that is to say, of each unit — an endowment of it with the power of change such as is not the power of any one unit, but the accumulated power of the system, refluent from all the units to each of them.

The phenomena of chemical combination, whether occurring in the laboratory or in Nature, all point to accumulation of power in a system near or remote. The atom is the summated property of the electrons, positive and negative; the behavior of a planet is inextricably bound up with the total character of the masses and moving configurations which we call the solar system. The organs of the living body are obviously in the service of the total system to which they belong; each depends for its structural integrity and functioning upon the living body as a whole; similarly system-sourced rather than self-sourced are the various internal and relational activities, the capacity for self-repair and the power of reproduction. As the ether unit demands the universe, and the cell requires the organism, so the living individual demands the society of individuals as the condition of its own adaptations and activities. The single organism, panmixia and inheritance understood, implies and involves the dominating system or species: without it no individual characters could come into existence or endure. It is especially the system, after sex has made its appearance, which keeps individual adaptations true to the general conditions that affect the whole species. And it is this total weight of the system, so to speak, which is behind the conservatism of the reproductive germ, holding it to inherited character until the sum of the individuals, yielding to new conditions, or jointly moving forward to more economical and efficient forms, at once permits and insists on modification.

Language and thought are inconceivable as self-sourced powers: like structural adaptations, they are at once individual and social products. To say that speech arises in satisfaction of a social need is a commonplace. There is a deeper aspect of language which is usually ignored. The word sound, the word sign, are ultimately imposed by the system: neither can arise without its consent, nor can either be useful save as the system determines its character and form. As means to coöperation in both language and thought, the speech elements must have a like meaning for all the members of a community; as each passing generation falls away, it is the community which, through imitation, the path of least stress, reimposes on the individual the lingual forms that are essential to its life. It is the social system, moreover, which, by the panmixia of mental intercourse, works continually to preserve those uniformities on which the usefulness of language ultimately depends. Where there is imperfect unification of the time-and-space life, as in the case of savage tribes, the imperfectly exerted stress of the system permits divergence from forms both past and contemporaneous. But in advanced stages of unification, where literature helps to stereotype language, the speech elements are kept for long periods relatively uniform and enduring: even the license shown in dialects, being due to a measure of isolation, does but prove the rule. The gradual changes by which words are differentiated, whether arising through the specialization required by function, or by reason of the stress impelling to economy and efficiency, are all of them not self-sourced, but manifestly system-sourced. Nor is it otherwise with the slow vicissitudes which custom sanctions in the sounds and meanings of words; for while these may originate in the individual or in the group, it is the sum of individuals and groups which either accepts or rejects them.

Recall what has already been said regarding the dependence of the individual word sign for its value on the meanings of other words of the same class, it being these which help to make it definite: indeed, without the differences, the contrasts which they supply, it could have no meaning. What is true of the individual word sign, and of the concept which it labels, is true also of the class of word signs, of the class of concepts: these are also rendered definite by the antagonism of the differences that relate them to other classes. And as we pass from one class to another in the order of increasing generality — class related to class by the links of superficial difference, as well as by those of fundamental likeness — we find that the meanings in each are determined and rendered definite by the meanings in all. The "practical value" of this relation of system to unit is seen in the process of acquiring a foreign language, where resort for the meanings of words is frequently had to the "context." The manner in which the system reinforces the unit is also suggested by the injunction, so often dealt out to a pupil needing aid, "Read the whole sentence!" The power of the context, the manner in which the degree of that power depends on the number of the impressions involved, are also to be recognized in the wider field of ideas: compare one's memories of a modern "short story" with the lasting effects produced by canvases vast as those of Walter Scott, Victor Hugo, Leo Tolstoi; the yield of a brief textbook description of Frederick the Great with the mental deposit left by Carlyle's lengthy treatment of his hero. As every statement about Nature, every formulation of a principle or law, takes its definite interpretative power for knowledge from the meanings of other slightly differing propositions of its own class, and then from the superficially unlike though fundamentally like propositions constituting all other classes, so the reaching of fruitful ideas in any field of investigation is itself facilitated by the amount of knowledge the mind can concentrate upon each problem as it arises: the more the results of many inquiries can be focused upon any particular inquiry the more hopeful becomes the solution. As what is happening in any particular area of the cosmos is determined by the cosmos as time-and-space whole, so the context of final interpretative value for any particular Nature problem is our accumulated knowledge of the universe.

Our impressions in art are similarly conditioned. The aim of every artist, whether consciously held before him or not, is to recruit the system by the contribution of the unit, to enrich the unit by the domination of the system. Is he producing a literary composition? — then each division must take its structure from the character of all the divisions. Is he painting a picture? — the thought of the whole must be present in the execution of each part. It is essential to the impression that the figures in any art product should in a large and general sense reciprocally involve, interdetermine and demand each other. The significance of each object depicted comes to be amplified, enriched, and therefore completed by the objects as summated in a whole — by the picture in its totality. The effect of the single figure, that is to say, is an effect of the figure itself plus the effect of all the figures, so that none of them can be abstracted without giving rise to a sense of loss, of incompleteness. It is this sense which protests, as it were, against the removal of some familiar building from city street or square, or of the long contemplated object from a well-ordered room. Wherever one element is abstracted from a whole, it is as if the system demanded its restoration; wherever most of the elements are abstracted, it is as if those which remain insisted on repair. Nothing in any whole set up by Nature or assimilated by the mind is " fair or good alone ": " all are needed by each one," whether that one be the flower less beautiful without its habitual environment, the cell functioning for the whole organism, or the power unit inconceivable without the cosmos. And the sense of incongruity with which the mind resists the abstraction of elements which it has organized into a system is but the conscious, highly complex form of the resistance which the living body opposes to changes in its structure and process, and which the universe offers to diminution of itself.

The need of unit by system and of system by unit is well seen in the relations which make up human society. An example is yielded by the popular estimate which classes men according to their race, nationality, religion or politics: to biography belong the elaborate descriptions of natural surrounding, inheritance, associates and friends on which all satisfactory portraiture of the individual is known to depend. The modification of the individual wrought by organized numbers takes its beginning in the home, and is implied there even for the years beyond youth in the saying that all calculations as to what a man will do are thrown out of gear when he marries. Losing to some extent, as member of a family, his strictly individual character, he takes on a sort of collective personality partly made up of the personalities and interests of the various individuals who constitute his household. Membership in a club or society subjects him to a further set of influences, and the changes wrought thereby are none the less real because of the varying motives under the influence of which men seek the expansion that comes from contact with numbers, or covet the multiplication of effort that results from their interorganization. Note by way of further illustration the difference between the attitude of an individual employer and that of a corporation; the new dignity always conferred by official position; the curious feeling of superiority felt by the resident of a metropolis over the denizen of a small town or country village, paralleled only by the manner in which the professor of a great university is said to "look down" on the whole faculty of an unpretending college.

The same action of system on unit is felt whether a group be assembled for instruction, for entertainment, or merely for social intercourse. So considerable sometimes is the change imposed that to people who know the individuals only in their domestic life a new set of manners seems to have sprung into existence. Frequently a charming grace, alike of bearing and speech, is the outcome; even where attitudes, gestures and tones of voice seem over-adapted to the occasion, no artifice of behavior, however exaggerated, ever obscures the fact that the units of such a group are in a very true sense under the compulsion of the system. In public meetings a positive constraint manifests itself, and is none the less extraordinary because it is taken for granted. It is as if five hundred or a thousand people, sturdy asserters of their "rights," had combined to repress freedom — to keep everybody attentive, respectful and almost motionless on these public occasions. The speaker must himself lose, in language as well as in manner, something of his liberty of action: even his thought must be conventionalized. Yet while thus under the stress of his audience, he is simultaneously dependent upon it for the power of his public performance. The sense of what is expected flows to him in waves, as it were, from those whose spokesman he is, and it is this inflow that tides even a shy orator far above the personal limitations to which he would otherwise inevitably succumb. Something more than his own resources seem then at his disposal; a unit, he functions with the aid, and therefore with the power of the system. He has become the instrument of a group; in the work assigned, the audience, however subtly, lends him its power.

It is but a step to the larger borrowings of individual life from community life. Customs, however originating, take their immediate binding power from the whole past and present of the social system. In all conduct known as conventional, deference is paid to a total body of opinions; moral conduct, whatever its sanctions, is ultimately traceable to the time-and-space whole which we call society. The same relation between unit and system which exists within the nation is equally obvious as international, and there is an advance in the larger as well as the smaller system towards a completer interdependence of part and whole. The growth of international obligations, juridical, political, commercial, industrial; the numerous agreements, explicit as well as implicit, by which peoples and nations accept regulations to be observed by each; the movement of all communities towards limitation of the injuries inflicted upon non-combatants by war, as a preliminary to the prohibition of war — all serve to remind us of a process which more and more tends to make each nation a contributing, benefiting and yet subordinated member of that larger community which is one day to be coextensive with the world.

That the subordination is one of delegated power as well as of submission is shown in the sense of dignity with which in some foreign capital the special agent, consul or ambassador defends the interests of his people; in the moral strength derived by a general conducting campaigns from the thought that he is the instrument of his nation's will; in the feeling of loyalty among soldiers, intensified by the comradeship of battle; in the devotion of the civil functionary, upheld by the knowledge that his country supports him in his work. The quality known as courage really proceeds from an idealized sense of some wider system whereof the individual is an integral part, whether that system be the tribe, the social community or the nation. And if we reserve the term courage for cases in which such sanction and support are already extended, we link heroism with the same process by tracing it to belief in that wider support and sanction which, even if not yet yielded, are none the less inevitable. There is usually much blame for men who fail in social activities that call for courage, and this for the reason that the quality is immediately imposed and rigorously insisted on; there is much less disrepute for men who fall short in the heroic elements of individual character, since the lack of these is not merely condoned, but frequently demanded by the community, which rarely looks beyond the interests of the moment. The courageous man is already assured of the approval of his group; the heroic man, who may be regarded as championing the interests of his race without immediate reference to those of his community, anticipates, however vaguely, the recognition which is to come from the larger system to which he belongs. Courage, that is to say, is a manifestation of solidarity with the present; heroism a union with past, present and future, in which the individual stretches out to the total life of humanity.

In all these cases the social system presented as dominating the unit individual must be regarded in its three aspects. The influence of the past over our thoughts and conduct is seen in pride of family, pride of class, pride of race, as fostered by oral and written traditions, by history, by literature; the social system touches us in the busy life of the present with a thousand reminders of our subordination to it, of the domination with which it limits and yet enriches our lives. A compulsion none the less real streams in upon us from the future of which we have directly experienced nothing. We gain the power to realize that future from both past and present, and the ideal elements thus won help in definite ways to determine our action. Every plan which we form, whether for the production of a machine or for the reorganization of a community, enters into the sum of the influences that control our lives. Ideals are anticipations of an order yet to come. By mentally picturing what the world is to be — by planning to make the world what it ought to be — we help powerfully to lead the present into the future, and thus to complete the complex of determinations out of which that future must arise.

Beneath all the impulsions that reach us from the human society, of which we are parts — beyond devotion to one's family, to one's country, to one's race — man has always been conscious, through both emotional and intellectual elements of his nature, of a wider system which, connected with the material world as its creator, maintainer and destroyer, is also the source of his own limited organic powers — a system through contact with and adaptation to which his personality is enlarged, expanded, completed. It is the religious feelings which, explosively as they may sometimes manifest themselves in the individual, have always burned with a steady flame in the race, that reveal more intensely than any other the dependence of the human unit upon the dominating universe. It is these which, reinforcing the "must" of duty, suggest the sway of the vast interests to which conduct asks adjustment — interests immediately human, yet ultimately cosmic; it is these also which help men to feel, not merely the grip of the total past, present and future of the race, but also that more mighty impulsion to right action which is symbolized for us in the thrust from which Nature's own harmonies proceed. Alike in its effort to reach a useful theory of change, and in its acknowledgment through worship of the power on which all life and welfare depend, the human mind has been ever reaching out to the cause uncaused, to the ultimate system of things.

Through all our experiences, emotional as well as intellectual, we are conscious that phenomena do not adequately represent our interest in the world. Beyond the limits of sense that hem us in — beyond the limits to which the absolutist pares down the universe — we stretch out to wider and more satisfactory horizons. As we round out the interrupted line into the ampler curve, and build up fragments into completed wholes, so do we follow the contracted area of the visible into the vaster realm of the unseen. As poets spiritualize the world by viewing its objects as wholes, so optimists catch their inspiration from a total system by which each unit of experience finds itself illuminated and rationalized. Recognizing that the reality of things is made up of future as well as of present and past, we push on our adaptation to something of larger scope and greater efficiency; unsated with the achievements of the hour, we aspire to a completer harmony and a more perfect beauty. It is this belief that things form an interdependent totality, not unit-sourced but system-sourced, that lifts us above the despondency of special condition, and takes the sting of pessimism at once from the error entrenched in an ignorance not yet dissipated and from the wrong we must contemplate but cannot immediately set right. Dissatisfaction with the unit until it is adequately related to the system; discontent with the system until we can regard it as working to rationalize, harmonize and beautify the units — these have their parallels in a process vaster than that of life, and are the sure signs of our inheritance from the cosmos.

CHAPTER XIX

COSMIC SELF-MAINTENANCE: THE UNIVERSE AS PURPOSIVE

The knowledge that we are denizens of a world of power, and subject to manifold stresses from it, begins with our familiar daily experiences. The tremor set up by the heavy wagon on stone pavements, the boom of distant guns, the bursting concussions produced by the near explosion of gunpowder or dynamite, all apprise us of a something which, being struck, transmits the force of the blows as vibrations. Taught by science, we also learn of a "medium" subtler and more pervasive than air from which and through which come the forces at work in light and heat, electromagnetic action, chemical combination and gravitation. For all these phenomena the assumption of an ultimate and universal source of energy from which they arise is inevitable. The discovery that the electrons may attain to nearly the speed of light can only mean that they are not moving "of their own accord," but get their velocity from the system through which they move. The existence of an enormous stress in ether was long almost an axiom in physics. Said Sir J. J. Thomson, expounding the nature of matter: "All mass is mass of the ether, and all kinetic energy kinetic energy of the ether. Only if this be so, the density of the ether must be immensely greater than that of any known substance." ("Electricity and Matter," p. 51.) According to Prof. Reynolds "the ether is 10,000 times denser than water and exerts a mean pressure of 750,000 tons on the square inch." ("The Structure of the Universe," Rede Lecture, p. 14.) That ether stress must be assumed in all material aggregations is shown by the fact that various substances, when reduced to powder, may be restored by pressure to their homogeneous solid condition. Thus Spring produced from the powdered nitrates of potassium and sodium, under a pressure of thirteen tons per square inch, homogeneous transparent masses of slightly greater specific gravity than the original crystals, but not otherwise to be distinguished from them. From a mixture of copper filings and water he also produced by pressure perfectly homogeneous cuprous sulphide. In like manner, by subjecting carefully dried powders of potash, saltpeter and acetate of soda to pressure he caused them to exchange their metallic bases and form nitrate of soda and acetate of potash.

We know the system of reality, then, as power, with its characters of extension, succession and number. The interactions of energy and matter at the surface of our own planet show it also to be two-sided, our experience being that no motion can be set up, no work done, except against inertia, against opposing stress, against resistance or strain of some kind, with the reaction always equal to the action. Now that which obtains for motion must also be true for the things which move and for the power which produces the movement. If power is two-sided anywhere it must be two-sided in the ground of the cosmos; if matter be derived from ether and the two interact, the presumption that the stress-restress relations which moving matter displays have their origin and foundation in the stress-restress relations of the ether itself is irresistible. Equally unavoidable is the view that as action and reaction are equivalents, neither side of which would be power were the other lacking, the ether units must also be likes to each other, since any unlikeness would be so much non-existence. What we envisage in the cosmos is a dynamic unity of interdependent antagonisms each of which is necessary to all, all of which insist on each. As there can be no stress against nothing, the ether unit exists only as exerting stress against stress; essential to it are other stress-exerting units, still others to these, and so on throughout the system. As power is thus two-sided, or not at all, unit and universe are reciprocally needed by and involve each other. In a cosmos thus dynamically one, forming a divisionalized unity rather than an aggregated multiplicity, where all the separate antagonisms are necessary to each other as the condition of each, and each is required by all as the possibility of all — where the system-sourced stress of each unit subordinated has against it the system-contributed stress of all the units dominating — the summated potencies of the universe must be conceived of as a power reflowing to the units as a power of conservation. The primordial function of the cosmos as accessible to us is thus self-maintenance. But the maintenance remains passive as long as the ether units remain likes to each other, stress and restress being instantaneous, equal, balanced. Motion can arise only when there is unlike or differential stress — stress greater in one direction than in all others, action greater than can be instantaneously met by reaction. This comes when, with the differentiation of ether into matter, differential stresses start into being, requiring motion to supply them, either immediately or ultimately, with the equivalent restresses which are needed to ensure what is familiarly known as the conservation of energy. For whether delivered at once into the resistance, potentialized as position, or stored up as unresisted motion for future delivery, energy is always kept two-sided. Its conservation, alike in the primordial form as ether and in the secondary form as motion, is just this exacted reciprocality of stress and restress which is its very nature. The universe is at once a self-differentiating and a self-equalizing system. It must develop the difference which is its superficial and temporary character; it must insist on the likeness, on the two-sidedness which is its fundamental and enduring character, and it is this intermittent production of the one, this eternal working towards the other, which constitute what we call evolution.

Kinetic energy, then, must be envisaged as a secondary and derivative form of constitutive universe power, as the conservation of energy is a secondary and derivative form of the conservation of things. Motion is a way in which the ether system sooner or later completes the incompleteness of differential stress, balances expenditure, maintains the store of energy, of power, undiminished. Analysis further shows it to be a procession from conditions of differential stress requiring change towards conditions of equalized stress involving the cessation of change. A body differentially stressed moves from the direction of greatest stress towards the direction of least stress, and does so even when account must be taken of the difference between traction and thrust, as well as of the contributing and opposing stresses which may enter into each particular case. As change automatically ceases when the equivalence in restress has been gained — when the differential thrust is balanced by the resistance — the motion process inevitably results in the setting up of enduring positions, configurations and forms. The effect is disguised, but not invalidated, where energy appears to be stored up for future delivery as in the case of the planetary revolutions. For even here each body in motion, though it be claimed to move through " frictionless " non-resisting ether, moves none the less under push or pull from every other body in the system as well as from stellar systems vastly farther afield — has to reckon with differential stresses of unlike amount and varying incidence in every area in its path. The fact that under these conditions of conflict the planetary motions are harmoniously interadjusted and the planetary periods kept uniform points unerringly to an equalizing process by which the differentials of the system are automatically eliminated.

With the appearance of matter, differentiated in some unknown way from ether, there are introduced into a system of units under equalized stress a number of material units under differential stress. If only one unit of matter were thus differentiated the stress on it would be the same from all directions. With many such units arising, a relation is set up which results in motion. We must assume, if only symbolically, that they shield each other from a stress which acts with like intensity on all, and that because of this shielding the pressure from without them, along a line joining their centers, is greater exerted inward than is the stress within them exerted outward. For gravitative action there is thus required not a private relation between the gravitating bodies which leaves the cosmos out, but a relation between them which is dominated by their larger relation to the system through which and by impulsion of which they move. From the fact that the differential stress out of which it arises is present in every area of the universe, however minute, it follows that the gravitative force is not propagated, but is perpetually exerting itself upon material bodies, whether "screened" or "unscreened," whether moving or at rest, wherever they may happen to be. They are set in motion, accelerated, slowed down, or brought to rest immediately by external force locally applied, but ultimately by the total power system which we call universe. Alike for bodies that meet with a resistance which finally brings them to rest and for members of moving systems which are sooner or later adjusted to each other by equilibration — alike for forces gravitative, electromagnetic, chemical, biochemical and muscular — change is a procession from conditions of differential stress towards conditions of equalized stress. Motion and change of motion are ways through which differential stresses automatically eliminate themselves by finding their goal in configurations and forms that endure. And it is these forms which we know as teleological, purposive, "intelligent." The sign of their teleology, simple and complex, incipient and complete, is equalized stress — the endurance which, relative as it may be, results from the automatic elimination of differential stress. They seem "designed," "put together for a purpose," display the character of "intelligent adaptations," because they are so many goals of conservation reached by a self-maintaining universe engaged in converting differences into likenesses.

The process which, by converting differential stresses into equalized stresses, results in teleological forms — forms which, interassimilated or self-assimilated, tend to endure — finds familiar illustration in the rounded shapes set up by friction. In a box or other receptacle, mounted so as to insure the equable distribution of the stresses exerted, shake together a number of irregularly shaped lumps of matter just friable enough to yield to the abrading action to which the agitation will subject them. As that action proceeds it will be found that the lumps, originally irregular in form, gradually become rounded, each finally approximating, if only roughly, to the shape of a sphere. And this result is even more impressive where Nature is the experimenter. The occasional boulder, perched high on some overhanging cliff, tells eloquently of the glacial action that has smoothed its sides; yet the more obvious process is that which led Playfair ("Illustrations of the Huttonian Theory") to compare the blows dealt against shore-cliffs by boulders, gravel and sand swung forward by the breakers, to "a kind of artillery." And Geikie ("Text-Book of Geology," p. 747) reminds us that "during a storm upon a shingly coast we may hear at a distance of several miles the grind of the stones upon each other as they are dragged back by the recoil of the waves which had launched them forward," adding that "in this tear and wear the loose stones are ground smaller and acquire the smooth, round forms so characteristic of a surf-beaten beach." The whole coast is paved with these rounded shapes of all sizes, some so exquisitely finished as to bear likening to the products of the lathe and the turning tool; or one may find all stages of the process represented, from the rough block whose angles have just begun to be worn down to the long abraded pebble which, whether oval-shaped or rounded, has taken on, at least some of the characters of a sphere.

Now that which happened to the lumps in the artificial experiment has happened to the rounded stones on the beach. In each case the masses have been hurled against each other and against the manifold irregularities of their environment, so that from a process involving incessant collision and friction, perpetual rubbing and abrasion, the blocks have emerged not merely reduced in size, but reduced in a highly special and peculiar way. Why does the lump or block take the rounded rather than any other form? An object irregularly shaped cannot be thus modified unless there is a selection of some portions of its surface rather than others to receive the abrading action — unless, in other words, the majority of the blows received are preferentially directed, and are thus directed rather to the protruding angles of the objects abraded than to any other portions of their external area. Obviously, the condition which diverts the abrading action from particular portions of that area is nothing other than the existence of protuberances in such preferred area. By further considering the problem we are led to the conclusion that there must be some form of surface for objects thus dealt with — taking the law of general averages into account — in which all the areas would be equally affected. And we reach the view that it is the spherical form, or some near approximation to it, in which the friction, the abrading action, would be uniformly distributed; that the spherical shape is therefore the shape at which the preferentially directed stresses cease and the uniformly distributed action begins. Once this form has been attained, differential action on the surface of the object ends, because all areas of that surface, being equally protuberant and non-protuberant, are equally affected. The object may be diminished in size by further abrasion, but it remains more or less crudely, more or less completely, spherical in shape. It has reached a teleological, an enduring form, and has acquired that form by movement away from conditions of differential stress towards conditions of equalized stress.

This kind of interassimilation — the reduction of masses to a particular, a least-resistance form — finds its parallel in the process of cosmic aggregation: there as here the spherical form or some approximation to it represents those conditions of equalized stress in the absence of which differential stress continues, on the reaching of which differential action ceases. There are no cubic suns and no square moons accessible to vision; the planets and their satellites all have rounded, sphere-like forms; we find plain evidence of that form in the stellar nebulae and clusters, as well as anticipations of it in the spiral nebulae; it is revealed even in the orbits which planetary bodies describe around their primaries. A common process must be at work in all these cases, reducible in method to the action of some kind of differential stress which has its goal in the setting up of equalized stress. There is no abrasive action when a sun or planet is formed, yet the conditions under which its units combine, gaseous or "molten," lead inevitably to the spherical shape. Such masses begin as diffused units and close up under chemical and gravitative action into aggregates. Each area of the condensing mass yields to the in-thrust or in-pull until it can yield no more, and as all other areas are thus affected, the enforced balance of each against all, of all against each, ensures the form in which all the peripheral curves of the aggregate resemble each other and in which each point of its periphery is approximately equidistant from the center with all other points. A like elimination of differential stresses, achieved in another way, is also responsible for the curved orbit, beginning with shapes of great eccentricity, such as those of comets and meteor swarms, and culminating in that nearest approximation to the circular orbit with which we are acquainted — the ellipse shown by the planets of our own system. In all such orbits, the adaptation of the various bodies to each other's motions understood, we see an equalized-stress balance set up between the gravitative in-thrust and the centrifugal out-thrust.

Returning to processes at work on our own planet, let us pass from the case in which the equalized stress form is set up by disintegration, to one in which synthesis or integration is at work. Involved in the consideration of it is the part played by plurality, for without numbers — separate units of matter capable of being associated and dissociated — there could be no intelligent adaptations in Nature, nor could any problem of "design in Nature" ever arise. As creation is not merely the differentiation of ether into matter, but also the collocation and re-collocation of material units and of aggregates of them, so the purposive forms which arise from the process imply collectivity as their pre-condition, and become intelligible to us only to the extent that collectivity is assumed. All known bodies are built up of ultimate units which, taken separately, are likes to each other, and taken in relation to each other, may become unlikes: how they act, what "properties" they manifest, depend ultimately upon the way in which they are collocated, and therefore upon special conditions of position and motion, not upon any qualitative potencies which they possess independently of each other and of the ether system. The simplest collocations in Nature take their rule from this combined separateness and plurality plus the motion process. See what happens when we place small shot in the concave of a watch glass. When two only are deposited, gravitative action brings them together, and there is no alternative collocation of them which is rejected by that action. It is otherwise when the experiment is made with three: in this case a manifest preference asserts itself. A strictly linear arrangement, collocating the shot in a straight line, is theoretically possible, yet what happens is the arrangement of them in the form of a triangle. In the linear order the conditions favor motion of one or other of the outside shot; in the triangular arrangement the conditions make further motion impossible. The passage of the shot from the linear to the triangular form is really a passage from conditions of differential stress to conditions of equalized stress — movement from a configuration subject to change to a configuration which endures. Nor is the illustration exhausted by the triangular configuration. If we add other shot, one at a time, shaking the watch glass as each is put in, it will be found throughout the trials that unteleological, unenduring forms continue to be rejected, while forms that endure, because they represent conditions of equalized stress, continue to be preferred. Each new figure set up by the addition of a shot is seen to have theoretical possibilities of arrangement which, though they may appear for an instant, are promptly rejected by gravitative action for the configurations more fitted to survive.

What we see in all these cases is the reaching of end by an elementary act of maintenance, related on the one hand to maintenance of itself by the universe, and on the other to the maintenance of itself by the organism. Effected without the intervention of consciousness and will, the preferences shown illustrate the setting up of purposive forms by an act of selection which, despite its superficially mechanical character, is plainly teleological.

The process and its results are the same whether the action is integrating or separative, whether objects are brought together or thrust apart, whether they reach a state of relative rest or are kept moving. Change in any configuration or arrangement is the result of differential stress, and the ultimate product of the change is a condition of equalized stress. Atoms, molecules, chemical substances, organic cells, tissues and organs all arise out of the process which compels change where there is differential stress, and ceases to compel it when conditions of equalized stress have been reached. Endurance in each case is the derivative outcome of universe self-maintenance, of the cosmic insistence on the two-sidedness of power, of the thrust which, sooner or later, results in equalization and therefore in enduring forms. Simple in the inorganic, where the collocated things may be electrons, atoms, molecules or planets, the teleology of the process is highly complex in the organism, where endurance involves the system in self-maintaining activities.

Cosmic self-maintenance, then, works out as purposiveness, and does this by setting up the enduring forms which, in virtue of both process and result, mimic conscious design, suggest plan, seem as if shaped, aggregated or kept in balanced motion as the result of purpose. The end to be reached is endurance; and it is reached by the automatic elimination of the differential stresses which cause motion and bring on change. Purposiveness is rendered possible by the divisionalization of power, permitting the arrangement and compounding of material units into aggregates — a collectivizing process which gives rise to form; by the law of change or motion, which begins and continues as long as there is differential stress and ceases when there is equalized stress; finally by the imposition upon the unit of the tendency or end of the system to which it belongs. When material aggregates arise the unit gains something and surrenders something by entering into relations with the other units: it yields its freedom to "go its own way" and gains whatever powers of motion and endurance are conferred on it by the system. Before collectivization of them the units are in a sense absolutes. Such properties as they have operate unmodified. But gravitative, chemical and electrical forces come into play and deliver them from their separateness. The electrons form atoms, the atoms molecules, the molecules aggregate by a process which culminates for the inorganic in suns and planetary families; where conditions favor the higher kind of collectivism there arise the wonderfully complex combinations which make vital phenomena possible. In all these cases the units close up into a whole wherein what each of them shall do is more or less determined by what all of them must do. The organic unit takes its function and acting, therefore its structures, from the system. The inorganic unit preserves its individual nature even in a collectivity, and yet in the broad, dynamic, non-organic sense it none the less comes under the control of the aggregation which it unites to form. Chance may continue between systems un-unified with each other, but within systems it is reduced by collectivization to a minimum. The whole drift of things from absolutism to relatedness is a drift towards purposiveness away from fortuity. Nor does the process differ when organisms gather into animal and human societies. Here also the unit, while remaining an individual organism, comes under the determination of its system. That man's subjection to his own society takes effect, not by a series of pushes and pulls, but through mental states involving consciousness, memory and will, neither makes the control less effective nor differentiates it in any fundamental way from the like process in the physical realm.

Note that while the power system is our primary assumption, that system becomes intelligible to us only as displaying what may be called its two universal and fundamental categories, likeness and differences, the one ensuring endurances, the other involving change. The continuance of the system is bound up with the maintenance of the ether or power units as likes to each other; in its secondary aspect the "conservation of energy" requires that action and reaction shall be likes. Were ether to remain homogeneous, every unit like all the rest, there could be no movement, no evolution, no purposiveness. Change is made possible by the unlikeness of matter to ether, therefore by differences, which means differential stress. Many differences and likenesses are merely form values, but when they take on dynamic character the outcome connects them inextricably with change on the one hand, with endurance on the other. In this sense all kinds of motion may be summed up as due to differences, as all kinds of endurance may be summed up as due to likeness, the exceptions being met with where difference is needed for function. Sorts of matter differ from or resemble each other, but they are all made up of like ultimate units; aggregates of matter from atoms to suns are ultimately systems of likes. Organisms from highest to lowest have their simpler and general functions alike; the structural likenesses of individuals to each other within each species, human individuals included, are overwhelming, whatever the superficial differences may be. As the universe works to bring difference back to likeness, so there is an assimilative process at work in the species to keep its individuals true to type, and a like process that slowly but surely assimilates races and nations to each other after they have been differentiated. Social life is assimilative, as we shall see more fully later; minds feel the influence of differential stresses and become more like each other according to the degree of the association. The shallower the intellect the more it is impressed by difference; the profounder the intellect the more does it seek out and recognize likeness; it is the existence of likeness in Nature which has made analogy so fruitful a factory in discovery: note the saying attributed to Plato: "Analogy explains the totality of things." As differential stresses to which the organism is subjected from without and from within, all of the same general kind, are reduced to the equalized stresses of structures, each organ fashioned by the total activities it must perform, all such activities fundamentally alike though superficially different, so the differential stresses out of which mental activities arise are solidified, as it were, into concepts, and so the common ideas of a people and of a race constitute goals of endurance reached through change — results of equalized stress produced by differential stress.

We thus envisage the universe, broken up into differences, striving incessantly for likeness and therefore away from configurations that are chaotic towards forms and movements that suggest design and mimic plan. The goal of change is end — the end of continuance, endurance — reached either by ways in the one realm or by so-called "means" in the other. "Intelligence" is not primarily conscious, but primordially dynamic. The living body has the cosmos for its original type; the cosmos is the pre-vital anticipation of the organism. Self-maintenance is the general function of both, constitutive in the universe, derivative in the organism. It is because the cosmos of power is Nature's artificer that the organism also shapes and fashions within itself; it is because the organism is the unconscious maker of its own tissues and organs that the conscious forms of activity arise and that man is enabled to work "intelligently," with "plan aforethought," towards the ends of human self-maintenance.

CHAPTER XX

UNIFORMITIES OF SUCCESSION

In dealing with the cosmos we deal with the original ether, with the matter that arises out of ether, and therefore with power. There are several objective categories under which this ultimate may be classed. It has extension as a system of co-existent units, succession as a system engaged in a process. Number belongs to it as divisionalized, and out of number come the possibilities of form. Most general of all are the categories of likeness and difference, arising out of and involving the rest; on them depends evolution itself. Were there no differences in things we should not be conscious of them; were things not linked together by likeness, no cognitions, and therefore no knowledge of them would be possible. A universe wholly made up of differences would be a chaos; a universe wholly made up of likenesses would be stagnation. Difference means differential stress and therefore change; likeness means equalized stress and therefore endurance. In a universe of equivalent power units which produces difference and works to restore likeness there must arise uniformities of motion and of form. In a system which is at once process and things engaged in process — at once a field for change and numbers engaged in change — there must emerge configurations that are symmetrical, harmonious, enduring, and therefore teleological.

The original likeness from which all derived likenesses proceed is the equivalence of the power units. Before the differentiation of them which results in matter, the ether system is in a condition of ideally equalized stress, and there is no succession: "Nature," as Balfour Stewart reminds us, "insists on difference before she will give us work." But after the appearance of matter change begins, leading to uniformities of both succession and extension. All gravitative and electromagnetic action, including the rhythmical vibrations we call light, has like time elements due to its foundation in like extension elements; it is this likeness in the ground of things which makes the rate of ether impulses rigidly precise, and ensures that gravitation shall continually recur as a force depending jointly upon the mass of the gravitating particles and varying inversely as the square of the distance between them. Natural laws in whatever field show us Nature perpetually doing the same things under the same conditions, so that there can be no juxtaposition of material elements, however apparently new, — no molar or molecular combination or re-combination of them, however seemingly unprecedented — no combination of them by the chemical experimenter however complex — and no problem however sudden that the electrician may submit to the ether system — which the universe is not instantly capable of dealing with, as if through countless ages it had rehearsed over and over again the infinite possibilities of change. The successive likenesses of planetary movement, of orbital and diurnal revolution, resulting in regular recurrences of season and growth, of night and day; the likenesses of method according to which atoms form molecules, molecules form substances and crystals arise; the repetitive equivalences of the pendulum beat, of the fly-wheel and governor of a steam-engine, of the revolving axles of machinery, of the to-and-fro motion of the watch balance — these are all united by the link of a common origin in the uniformities of power. And this unerring accuracy, this absolute justness, is the elementary form of that which in human society we strive to call justice.

Arising out of the realm of matter, as matter arises out of ether, are the organic uniformities that result from the living body engaged in self-maintenance and therefore kept uniform with itself. Here are repetitions which differ from the rhythm of the vibrating atom or molecule only because the motions involved are spread out and enormously more complex. Within the time area of birth, reproduction and death occur the various physiological rhythms of internal process and relational activity which are none the less repetitive because they seem to be determined, either immediately by characters of organic structure, or ultimately by characters of environment. Upon such successional processes as respiration, digestion, circulation and assimilation are superimposed the countless uniformities shown in the daily, seasonal, and periodical activities of plants and animals. The immensely superior ease of doing like things at like rather than unlike intervals may be realized by recalling the wave-like motion of the cilia of many infusoria, the regular beat of the wings of insect and bird, the recurrent and equally spaced movements of the limbs of quadruped or biped in walking or running. Man is himself ruled by the imperious necessity of so spacing his activities that they shall be separated by approximately equivalent time areas. Industrial movements of the most varied kind are overwhelmingly rhythmic. It is with equal strokes, where the work is individual, that the carpenter drives his nail, impels his plane, or urges his saw. In like rhythmic alternation moves the hammer of the tin-worker, the mallet of the stone-mason, the file of the mechanic, the spade of the coal-heaver, the foot of the knife-grinder. The rhythmic "click" of the type, as the compositor deposits them one by one in his "stick," does not cease, but only grows somewhat more complex, when the operator takes his place before a typesetting machine. Where function requires at least superficial difference, we get unequal spacing, as in the taps on the receiving instrument in telegraphy, yet even that difference is dominated by the larger uniformities of the time area considered as a whole. Where no functional difference is called for, the succession areas are equally spaced, as in the plunging stroke on the keys of the typewriting machine. The rhythm of collective activities may also be cited, as when rowers, swaying alternately to and fro, dip the oars simultaneously; when the nets are drawn in or the capstan turned by successive impulses; when threshers wield the flail after the corn has been harvested; when in the rice fields of the East the grain is separated from its stalk by stamping movements of the worker's legs; or when, with resounding blows, the blacksmiths strike alternately the hot iron.

The uniformities of the machine, alike of action and of product, are also noteworthy. For the machine, though inorganic in its material, is an extension of the living bodies of human beings whose experiences, experiments and inventions have made it possible. It is for the conscious planning of man what the living organ is for the process of unconscious design out of which the "intelligent adaptations" of plants and animals take their origin. Its parts, like those of the organisms, possess interdependence; they reveal interadaptation, along with characters of size, form and motion such as permit of their reaching of organic ends with the minimum expenditure of power and the maximum degree of efficiency; each unit in the structure of a machine is subordinated to all the units, and all the units dominate each of them. Observe also that the motions from which the activities of the machine take their rise are all of them circular motions — motions of revolving axles, pulleys and wheels — motions in a path all the areas of which are interassimilated, resemble each other, and therefore involve no change from the direction once begun. It is because of the superior ease of the repetitive elements of circular motion that so much of the work of the world is done by means of them; it is the uniform path, the uniform speed, and therefore the uniform time areas of circular motion which underlie the countless utilities — from the pin to the steam engine, and from the postage stamp to the newspaper — which the machine produces repetitively, each object the like of its predecessor, and all the objects issuing likes to each other, as coins issue from the mint. For as the organism, through the domination of the unit by the system, is kept identical with itself, and can reproduce its metamorphosed elements only as likes — can make a new cell or tissue only on the plan of the tissue or cell which it is to replace — so the machine, similarly kept identical with itself, is held by its own interdependent structure, the system dominating, the unit subordinated, to movements that are likes to each other, to the production of objects that are likes. And out of this identity with self and this insistence on likeness proceed the sound repetitions with which most machines announce their activity — the soft "buzz" of the electric fan; the whir of the ventilator and the hum of the dynamo; the to-and-fro clack of the shuttle in sewing machine and loom; the pulsing of the steam launch and the puff-puff from the exhaust of a locomotive; the recurrent plash-plash of the steamer's paddle, or the vibratory tremblings from its screw; the successive explosions of the self-impelled bicycle and automobile; together with numerous other repetitive sounds, from the tremors of the contact-breaker of an induction coil to the cracking detonations of a bullet-fed machine gun. The very language we use is in a sense alive with the rhythmic aspects of activities both inorganic and organic; such words as flicker, glimmer, sparkle, sprinkle, spatter, twist, twirl, wave, rustle, wriggle, hum, buzz, whizz, whir, rattle, at once imply and describe the repetitive sounds that originate either in the repetitive motions of inanimate objects or in the equally spaced activities of organisms and of the extra-organic appliances which we call machines.

It is here that we are reminded of the combined successional activities and sounds of the lower animal life. The tapping, grating and frictional notes are well exemplified by many organisms in the order of beetles (*Coleoptera*). There is a centipede (Eucorybar Crotylus) which makes a rasping sound; Darwin mentions a Brazilian butterfly (Ageronia Feronia) which is vocal with a " noise like that produced by a toothed wheel passing under a spring catch," and " can be heard at a distance of several yards." In the order of *Lepidoptera* there is one insect, setina, which " produces a sound like the ticking of a watch." (" Descent of Man," Chap. 11.) To the same general class belong the repeated notes of the cicada, the rhythmic chirping of crickets and grasshoppers, the more lugubrious alternating beat of the familiar " death-watch," and the humming sounds made by most insects which have wings. To these examples, which merely suggest without exhausting a wealth of available illustrations, may be added the evenly spaced notes of many birds, the cooing of doves and pigeons, the barking of dogs, the lowing of cattle.

In human beings the rhythms of action have attained to a highly systematic development in two directions — those of the movements or gestures performed in dancing, and those of the scientifically organized iterations of sound, vocal and instrumental, to which we give the name of music. Beginning with musical sounds, it may be premised that however complex they have become, the iterations of music always embody rhythm as their earlier and more fundamental element. We realize this by recalling the power of the simple drum-beat over a body of soldiers, as well as the fact that savages, in whom the artificially developed melody of fifes, violins and flutes produces aversion, respond readily to the simpler forms of rhythm. (Waitz, " Anthropologie," Section 1, p. 155.) In modern music we get rhythm in its simplest form supplemented with time variations and pitch; there is a recurrence of like notes, along with variety in duration; the lines are divided into equal bars, with the same time interval between each; in vocal as well as instrumental music there is mimicry of the tune proper by accompaniment of it in the lower octaves. In many compositions the main theme is repeated with variations. "Like conditions for like areas," or distributive assimilation, whatever superficial differences the areas may show, is the law for all music.

Observe also how the rhythm of song allies itself with the rhythm of movement in the melodies which ascend from the field of labor in every part of the world. These begin in mere interjectional forms, like the "*Zo ho*" of the Siamese, the "*Hu hu*" of the Chinaman, the "*Ona aa*" of the Japanese, the "*Hai na e*" of the New Zealander; they grow into more definite meaning in the "Heave-ho" of the British boatman, the "*Ey ukhnem razik*" of the Volga burlak; gradually we find them elaborated into couplets, and finally into versified songs, adapted to all phases of industrial and social life. No collective activity anywhere, it would seem, which has not been deemed worthy of a song; and all forms of toil have been thus accompanied — the carrying of loads, the pulling of ropes, the moving of beams, the felling of trees, the hewing of wood, the drawing of water, the grinding of meal and corn, digging, weaving and spinning, field labor in all its forms, and every variety of agricultural activity. According to Ratzel ("Völkerkunde," Vol. 2, p. 133) "the Maoris have a song for every form of labor — for the dance, when rowing, at play, and when going forth to battle. They are especially fond of alternating songs, in which choral effects are made, varied with solos." Burton, in his description of the East Africans, tells us that the fisherman over his paddles, the porter carrying his load, the housewife performing her task of rubbing down the grain, all accompany their work with song, while in the dances of this people "a thousand heels strike the ground simultaneously like one." Sometimes the laborer models the rhythm of his movement on the pattern of Nature sounds, as is suggested by Bergk when he says that the song of the eastern water-drawer represents a monotonous repetition of Nature sounds, accompanied by the monotonous movement of the laborer himself ("*ein eintöniges Wiederholen von Naturläuten, welche die gleichförmige Bewegung des Arbeiters begleiteten*"). Even to-day, as we are assured by Dr. Karl Bücher (citing from Sachau in "Arbeit und Rhythmus," Leipzig, 1902, p. 51), the Bedouins draw water for their cattle to the tune of a song which is heard at all the wells in the deserts of Syria and Mesopotamia.

Allied with the examples of repetition in music are the organic iterations which make up so large a feature of poetry. "Metrical feet," as Sayce reminds us ("Principles of Comparative Philology," p. 383), "whether quantitative or qualitative (that is, accentual) is the satisfaction of the striving after analogical harmony, of the desire of the mind and ear and lips for the like, which lies at the bottom of speech itself." Among the constantly recurring characters of verse are the assonances which precede rhyme, as well as rhyme itself. We find alliteration in the earliest efforts at poetic compositions, as shown by the Latin poet Ennius in his "*At tuba terribili sonitu tarantara dixit*" ("Tirocinia"), as well as in the more frequently cited line from the same author, "*O Tite, tute, Tati, tibi tanta tyranne tulisti.*" That such repetitive effects have long survived the introduction of rhymed endings into poetry comes out in innumerable examples — elaborate in Coleridge's

> In Xanadu did Kubla Khan
> A stately pleasure dome decree,
> Where Alph, the sacred river, ran
> Down to a sunless sea.

— simpler, yet not less effective, in

The fair breeze blew; the white foam flew;
The furrow followed free;
We were the first that ever burst
Into that silent sea.

There is meanwhile a repetitive effect in poetry which, at once primitive and modern, embodies alliteration as well as rhyme in iterations of both words and sentences. Tennyson has given us a modern example in his "Cradle Song":

Sweet and low, sweet and low,
Wind of the western sea;
Low, low, breathe and blow,
  Wind of the western sea!
Over the rolling waters go
Come from the dying moon and blow —
  Blow him again to me,
While my little one, while my pretty one, sleeps.

The art which thus repeats, not merely a sound, but also an idea with its associated words, finds its ruder prototype in the songs of all primitive peoples, and is especially well brought out in such race epics as "Hiawatha," of the North American Indians, and the "Kalevala" of the Finns:

Then began the reckless minstrel
To intone his wizard sayings —
Sang the oaks upon the mountains;
On the oak trees sang he branches;
On each branch he sang an acorn;
On the acorns golden rollers;
On each roller sang a cuckoo.
Then began the cuckoos calling;
Gold from every throat came streaming;
Copper fell from every feather,
And each wing emitted silver —
Filled the whole with precious metals.

Sang again young Lemminkainen;
Conjured he and sang and chanted —
Sang to precious stones the sea sands;
Sang the stones to pearls resplendent;
Robed the graves in robes iridescent;
Sang the island full of flowers,
Many-colored as the rainbow.

(" The Kalevala," by John Morton Crawford, Vol. 2, p. 465.)

To the realm of music belong also the repetitive effects of formally uttered human speech to which we give the name of oratory. There is always a repetitive division of the material into paragraphs; the so-called balancing of sentences, in which their forms are interassimilated, with the result of easier comprehension, is another example of repetitive likeness. Then there are the musical effects of oratory, reminding us of Grétry's description of "*la parole*" as "*un bruit où le chant est renfermé.*" In all elaborate speech there are waves of feeling on which the tones rise and fall; within the lower cadences, like notes continually recur, moderate as is the range; the rhythmic, intervaled repetition of like consonantal sounds, labial, dental, medial and guttural, makes repetitive symmetry of the very anatomy of speech. Finally observe the regular alternations of the short with the long sentences, of the affirmation with the question, and of simile and metaphor with direct statement.

The rhythms of animal life begin in the uniformities of rest and wakefulness, play and food-hunting, pairing and nest-building, estivation and hibernation. For human existence there is the night fire in cave or camp; the division of the bright hours into spaces for work and meals; the recurring periods of sacrifice and worship; the daily glow and gloom of the hearthstone; the morning ablution and the evening prayer — all repetitive habits of like or differing stages of civilization that have their analogues in the modern life of man. It is not only that work, rest and sleep follow each other for all peoples with a systole and dyastole as regularly recurrent as that of the heart: as special tasks divide the day, so the week has its church-attendance or theater-going, the year its politics and its voting, its stock-taking and rent-paying, its fasting and its "vacations." As the individual in any community cannot differ more than superficially from all its other individuals, so it is impossible for him to differ more than superficially from himself. Kept for the most part self-identical, he changes only within narrow limits: his activities are essentially repetitive. He comes to need the recurrences which have grown habitual to him, and frequently accepts without a murmur, even in the realm of opinion, the social expectation that he shall remain uniform with himself. The demand that human activities shall be repetitive extends also to conditions of life — to food, clothing, and friends. The very environment to which we are accustomed may come to be necessary to our happiness: the love of long familiar scenes, after all thirst for superficial variety has spent itself, is an enduring element in the history of the human individual, and constitutes a large factor of what we call love of country.

Note may also be taken of collective repetitions common to all types and varieties of human life. But for the key to them we must narrow our view, since while custom is imposed by the society of organisms it begins in the habit which is imposed by the individual organism. To activities once performed the body adapts itself, and the oftener they are repeated the easier they become. The involved facility and difficulty take subjective form — in the pleasure with which the individual repeats what he has done before, in the feeling of dislike or aversion with which he contemplates or performs the activity which is unfamiliar. Subjective attitudes of this kind show themselves even for civilized man in mere trivialities — in the half-superstitious fear with which he hesitates to vary from some doing or way of doing once begun, as if divergence from it might bring experiences prejudicial to his interest or welfare. We have here in all probability the real origin of the rigid prescriptions of ceremonial, as well as of the iron rule which custom imposes upon the members of a society. The unyielding nature of the grip which ceremony has upon the human mind, in both primitive and modern life, is well described in "The Ancient City" by Fustel de Coulanges (p. 223): "Every family, every religious family at least, had a book in which were written the prayers of which the ancestors had made use, and with which the gods had complied. It was an arm which man employed against the inconstancy of the gods. But not a word or syllable must be changed, and least of all the rhythm in which it had been chanted. For then the prayer would have lost its force and the gods would have remained free. But the formula was not enough; there were exterior acts whose details were minute and unchangeable. The slightest gesture of the one who performed the sacrifice, and the smallest parts of his costume, were governed by strict rules. In addressing one god it was necessary to have the head veiled; in addressing another the head was uncovered; for a third the skirt of the toga was thrown over the shoulder. In certain acts the feet had to be naked. There were certain prayers which were without effect unless the man, after pronouncing them, pirouetted on one foot from left to right. The nature of the victim, the color of its hair, the manner of slaying it, even the shape of the knife and the kind of wood employed to roast the flesh — all was fixed for every god by the religion of each family, or of each city."

As the individual organism, with its accumulated experiences embodied in structure reappears as a like by reproduction, so the society of organisms repeats itself, rudely or with elaborately developed instrumentalities, in the process of education. There is everywhere a new generation receiving from the old the acquirements of all bygone generations; and it is through this link between past and future that the customs, the institutions, the arts and the sciences of peoples, with comparatively slight changes, are perpetuated from year to year and from century to century. Larger than the movement within which there is repetition of particular habits, activities and ideas, is the movement of recurrence by which each community lives over again, so far as fundamental elements are concerned, the life of its predecessor. The precedent invariably cited in law to justify recurrence does not change in essential character, but only takes an immensely wider range, when appealed to in the conservatism with which societies resist the modification, by insisting on the repetition, of their hereditary structure. The superior ease of repeating what has been done once, already experienced by the individual within his own organism, is multiplied by an enormous factor when the repetitions are those upon which all the units of a social system insist. Meanwhile repetitive uniformity is controlled alike in the individual organism and in the society of organisms by the necessity of progress; yet when progressive variations occur, the differences they involve, instead of contravening the law of likeness, are in the interest of a more complex, a more economical, and a more efficient uniformity.

CHAPTER XXI

UNIFORMITIES OF EXTENSION

A SYSTEM of like power units differentiating itself into like matter units gives rise by motion and collocation of them not only to equivalences in time, but also to equivalences in space. The direction away from the greatest stress towards the least stress, whether compelled in the inorganic, or chosen in the organic, is the easiest direction; inevitably, therefore, where function does not require difference, this easiest direction is the direction which leads towards equalization, repetition, uniformity. As the electrons, founded in the equivalences of ether, come forth from it as likes to each other, so atoms arise which are likes, and so these, even when differing superficially, combine into molecules which for the same substances are all precisely of one kind. Crystals, again, are identified by constants that always recur. The systems may be cubic, tetragonal, hexagonal, orthorhombic, monosymmetric or anorthic, yet all the members of each conform to the system type, and whatever their superficial differences may be, all the faces belonging to any one crystal are connected by geometrical relations which obey the law of the "rationality of indices." Reproductive germs are produced as likes; buds, seeds and fruits resemble each other both in structure and appearance. Each tissue of the living body points unerringly to the uniformity of the cells and organic units which underlie it. In the plant and animal world the likeness of one member of a species to another asserts itself through all specializations enforced by heredity, and through all superficial changes which progress may demand or the environment impose. And though, in the case of men, complexities of maintenance, geographical peculiarities, local conditions may superficially differentiate given groups from each other, the general likeness of all human societies in fundamental elements — immediately determined by the likeness of the human organism, ultimately determined by the likeness of the environment to which it must be adapted — emerges for the intellectual vision through all the variety manifest to the senses, and through all the judgments based merely on the impressions of the moment. On this essential uniformity rests the fundamental oneness of arts, sciences, institutions, laws and ways of living. It is seen in speech, whether the language spoken be one-syllabled or many-syllabled, its structure polysynthetic, agglutinative or inflexional or post-inflexional; in the relation of human thought to practical needs, with its ever-recurring phrases and only superficially varying proverbs, as well as in the deeper outlook upon Nature, beneath whatever skies and through whatever shapes man has symbolized the creative power to himself in the religious view, or pondered over the problem of his whence and whither in the philosophical view. It is none the less eloquently, though more simply proclaimed in the saying that human nature is the same the world over.

Uniformities of succession often have uniformities of extension as their product; out of symmetries of motion arise symmetries of arrangement. Note the figures of Chladni, wrought in sand on a plate caused to vibrate; the two-sided light forms of Lissajou, projected upon a screen from two tuning forks of unlike pitch; the distributive and interference waves seen on a surface of agitated mercury, showing what Flammarion has called "a mosaic of rhythmical motions, a sort of visible music." The like "properties" of atoms lead to like molecules, like organic units, like cells; so the living organism, held to repetition of itself, turns out products that are likes. That function results in likeness as well as difference may be seen in such familiar examples as leaves, with their approximately like size, iterated veins and regular distribution along the stalk; in the scales of fish, the feathers of birds, the hair, teeth, nails and claws of many mammals; in the iterated markings of numerous insects, caterpillars and birds. Symmetry may be circular, radical, bilateral or longitudinal. It is circular or radial when the organism has an environment which is practically the same for it in all directions; and this happens either in advance of motility, as in the case of plants, or with lowly organisms that live in a wholly fluid surrounding. It is bilateral for organisms high enough in the scale to move in definite directions and towards particular objects; longitudinal as well as bilateral for organisms that are built in sections. All these types of symmetry find illustration in existing and extinct forms of plants and animals — the circular or radial in foraminifera, radiolaria, brachiopods, corals, tetra-corals, crinoids and starfishes; the bilateral in the feet of caterpillars, the wings of insects, in crabs, lobsters, in all vertebrates, and therefore in all the higher mammals; the longitudinal in the nodes of plant stalks and bamboo canes, in the spiracles of insects, the ribs of quadrupeds, in the iterated elements of the bony structure of fishes, reptiles, mammals, and in the repeated limbs of vertebrates.

Spherical and circular forms are the easiest to construct, whether Nature originates them or they are brought into existence by man. They intrude least into the environment, present surfaces that do not invite differential stresses from it, and are therefore most durable. Beginning in the stalks and stems of plants, they make an impressive display in both natural and human industry. Man loves to fashion in the round, and rounded products come forth multitudinously from his tools and machines. We find them iterated and reiterated in the pillars that support and ornament buildings, in pipes of every dimension; in bottles and crockery ware; in door knobs, axles, bars, bolts, nails and screws. Even when there is departure from the spherical in the interest of function, there is no less of iteration. The total shape is usually a combination of iterated like parts, as shown by beams, bricks, planks and clapboards in house-building; in window frames and doors, all of the same size; in shutters with their iterated slats, and in the shingles or tiles of the roof. Not only do many of the fittings within the house resemble each other in function, form and size: in our modern streets it frequently happens that all the dwellings are built on the same plan, are alike both as parts and as wholes. Even in more pretentious buildings there are numerous details, structural and decorative, that look as if turned out from the same mold. The plans of the architect already foreshadow the care which will be taken to follow the principle of uniformity. As modern pillars must be Doric, Ionic, Corinthian, Tuscan, Gothic, or some conventional composite of these, so the arches and curves of the stone-work and wood-work must resemble each other in conforming to some particular "style." The stained glass windows must harmonize with the rest of the structure; congruity should be observed between the kind of material used in the timbered ceilings and in that employed for the other furnishings. Characters of uniformity should also relate the order of architecture adopted to the ornaments, the chairs and tables, the window hangings and the carpets. As the book case ought to conform to the general plan, so the books should be "uniformly" bound. The pattern of the open grate, of the mantelpiece, the fire-irons, the lamp, is inevitably determined by the ensemble. Nay, the guests themselves who move within such harmonized surroundings must themselves be uniform — in what they socially represent, in what they wear, in what they do, in what they say, even in what they think.

As in the production of objects it is easier to make them likes than unlikes, so in their arrangement is it easier to place them at like than at unlike intervals. Equal spacing is frequently seen in the uniformities of extension. The likeness of the cylindrical, globular or hexagonal cells of wasps and bees is more or less a likeness of space interval as well as of form. "The work of construction," says Darwin, in explaining the honeycomb, "seems to be a sort of balance struck between many bees all instinctively standing at the same relative distance from each other, all trying to sweep equal spheres, and then building up or removing, leaving ungnawed, the planes of intersection between these spheres." Regular distances are kept by many birds in their flight, between the vessels of a squadron in motion or lying at anchor, between the individual soldiers, as well as between the lines and squares, of troops on the march, at review, or on the field of battle. We plant corn, vegetables and trees in equidistant rows or at like intervals; the fence boards with which we surround our fields and gardens succeed each other regularly, as do the telegraph posts in our thoroughfares. As the spider weaves its web so as to leave equal spaces between the threads, so the human artisan, working by hand or with the aid of machinery, observes the principle of like intervals. Note the meshes, narrow or wide, of many cotton and linen fabrics, as well as of numerous articles in silk, worsted and flannel. The lace-maker spaces equally, like the compositor; equal distances are observed by the tailor and dressmaker in placing buttons, braid and other ornaments of attire. When wire is woven to form sieves, screens, gratings, nettings, the same conditions for like areas are set up. The screw has its threads equidistant; neither watch nor clock could mark the units of time were it not for the equally spaced teeth of their wheels; the efficiency of sawing and boring tools, as well as the ease experienced in their use, depends largely upon equal spacing. The blades of fans and screw propellers, the buckets of water wheels, the boards of paddle wheels, the cups of turbines, are arranged on the same principle. Nails are driven in and screws inserted at like distances from each other. Not only do we keep the pages of our newspapers, magazines, books and note paper of the same size; we space our lines equally in both printing and writing.

In the realm of art there are numerous examples of spatial uniformity. The earliest forms of design, like the earliest forms of song and music, have the principle of iteration at their foundation, as we may recognize by examining the dots, lines, circles or zigzags which all savage peoples use in the production of decorative effects. A vast number of these iterations of early art have reached us from the primitive life of man on the planet: we find illustrations of them in the decorative and conventional designs of the paleolithic period, and in the geometric decorative designs used in western Europe during the neolithic period, some of which were continued into the bronze age. ("Prehistoric Art," by Thomas Wilson.) Nor does the rule of iterative effects pass away with the elementary social and intellectual life in which it is first manifested. All modern decoration is overwhelmingly iterative or symmetrical, frequently both: along with simple examples it includes a complex form of iteration which illustrates the rhythm of space, as music illustrates the rhythm of time — that union of unlikes to form likes which, beginning in the coming together of unlike atoms to form like molecules, is at last seen in the designs on cotton print, in wall-paper patterns, in carved-wood effects. Says Grosse ("The Beginnings of Art," pp. 149–59):

> When we compare the pattern of an Andaman girdle with the designs on our parlor carpets, we find that among all the differences one principle underlies both. The oblique strokes on the girdle are repeated, just like the flowers on the carpet, at regular intervals, and, like the flowers, form rhythmical series. But this analogy is not limited to this single instance. If we continue our comparative observations we become convinced that the principle of rhythmical arrangement is not less plainly and frequently evident in the art of the lowest savages than in that of the most highly civilized peoples. We have a right, therefore, to presume that pleasure in rhythm is in reality a universal human property. The essential feature of rhythm is the regular repetition of some particular unit; a tone, a movement, and — in the present instance — a figure. The rhythmic unit need not, however, be a unit in the strict sense; it is even the rule that it is composed of several elements; but it must in every case have the effect of a unit. The simplest conceivable case is evidently the one cited, in which a rhythmical series is formed by the regular repetition of a real unit — of a point or a straight or a curved line. In the decorative art of the highest peoples examples of this extreme simplicity are comparatively rare, but they are very abundant in primitive ornamentation. . . . No tribe, however, is limited to this simple style, but, as a rule, even primitive ornamentation takes pleasure in the formation of far more complicated rhythms.

The ordering of objects, in its simplest form, is the putting of like objects together; the placing of objects, whether like or unlike, at equal distances; or the shaping of unlike associated objects into likeness with each other. In its most complex form, ordering is the grouping of objects superficially unlike into larger units of likes. Ordering produces symmetry, either simple or complex, and often leads to it where dissymmetry is apparently in evidence. " The principle of symmetry," says Grosse (p. 153), " certainly has immediate and universal basis, for there is hardly a people by whom it has not been observed; and the carvers of the Australian shields as unquestionably recognize its value as the architects of the Parthenon. The sole exception that can be recalled is only apparently one. The Japanese always arrange their decorations unsymmetrically. But the peculiar charm of these unsymmetrical decorations arises from their connection with the symmetrical forms of the decorated objects. Japanese art is thus in no way independent of the principle of symmetry. It rather employs it just where it seems to contradict it." Ordering simple and complex, resulting in the symmetry that is only incipient or in the symmetry that is developed and complex — whether seen in the arrangement of the objects on a mantelpiece, of chairs in a room, pictures on the wall, statues in a public square; in the iterated figures of a decorative design, in a chemical molecule, a snow crystal or a solar system; in arrangements that require neither consciousness nor will to originate them, or result directly from human planning — arises in every case from motion away from conditions of differential stress towards conditions of equalized stress, away from difference towards likeness, away from the multiform towards the uniform. Hence it is that orderly shapes and arrangements are the easiest to produce; hence also that they are "intelligent," enduring, and therefore teleological. Trite, moreover, as all these illustrations may seem, it is the discovery of uniformities in the commonplace which is the beginning of wisdom. When rightly questioned, the ordinary, the taken-for-granted, reveals the order which is "heaven's first law."

That movement towards uniformity, likeness, equalization, in all the cases mentioned, is movement towards the direction of least stress and therefore easiest may be realized by imagining the difficulties which would be encountered were attempts made to substitute a rule of unlikeness for that of likeness. Think of a pedestrian endeavoring to take his steps so that each should be unlike all the rest in space length as well as time interval; of an artisan trying to exchange his equally spaced strokes for strokes at constantly varying intervals; of a manufacturer contriving machines which should substitute continually changing speeds for the motions that are regularly rhythmic and repetitive, and products varying from article to article for the products that are turned out as likes. What but an enormous waste of effort and time could result from applying a principle of difference to the multifarious structures erected, fashioned or fabricated by man — from making each step in the municipal stairway, for example, peculiar to itself, with an unlike architecture and spacing for every building and domicile, and a method of construction insuring that each door, window-frame, pane of glass, board, screw and nail should be unlike every other? And if man is held to the various likenesses here described by the difficulty of overcoming the differential stresses which impose them — by the very conversion of such stresses as mentally realized into activities which follow the direction of least resistance — how much more insistent must be the demand for such likenesses in the inorganic, where the process requiring that change shall start up from differential stress and find its goal in equalized stress is neither attenuated by organic complexity nor masked by consciousness and will, but founded in the very nature of cosmic power.

That a vast number of differences evade the equalizing process, either as constantly becoming or as in course of elimination, follows inevitably. Without differences in the inorganic there could be no change. Many unlikenesses arise out of the conflict of processes not yet unified, even impossible of unification, and therefore out of the very character of Nature as non-organic. Without difference in the organic there could be no special function. That pencils are sometimes hexagonal as well as rounded; that picture frames are oftener square than circular or oval; that all houses do not resemble each other; that the builder produces square or parallelogrammic as well as rounded forms in his constructions — all this arises out of imposed condition or of special end deliberately sought. A good example of these divergences is furnished by writing and printing; for though the assimilative process keeps the letters of the same size, function none the less demands those differences of form on which the meaning so manifestly depends.

The process that yields difference is indeed a prerequisite of the process that works for equalization. Yet the one is a disturbance, more or less local, the other an ordering, wide and deep as the universe itself. In sense contact with the environment, we are most impressed with Nature's variety. It is differences that furnish the shock needed for consciousness, and the overwhelming need of them for experiences at all gives unlikenesses a delusive right of way. Once the intellect is aroused and begins to play upon its material, the differences are seen to be everywhere superficial, the likenesses everywhere fundamental. We recognize the uniformity invaded as the beginning of new uniformities, the balance disturbed as the promise of wider and more complete equalizations. The differentiations which make atoms unlike each other are means to the likenesses of molecules, as the differentiation of tissues in the organism is a means to the likenesses which connect all organisms. By their division into industrial and social groups, each with its special activities and conditions, men were never more differentiated from each other in things superficial than they are to-day. They are more like each other in fundamental characters than at any previous period in the history of the world, and this likeness is a continually increasing value. Omnipresent is vicissitude in both Nature and life, but the existence of likeness in the midst of differences, of forms that endure in the midst of change, tells of a final triumph achieved against all change by change itself.

CHAPTER XXII

ASSOCIATION AND DISSOCIATION

The cosmos gives rise to difference, but is supremely a maintainer and restorer of likeness. Its drift towards enduring forms begins with the appearance of matter, and as forms endure only to the extent that differential stress is eliminated, the goal of the motion process, immediately or ultimately reached, must be likeness in one or other of its manifestations. For the senses, which seize on the momentary aspects of things, difference is the conspicuous character; for the intellect, seeking to comprehend things in their entirety, as space-and-time wholes, it is their likenesses which are important. Beneath all the juxtaposed variety of Nature, and within all its setting up of differentials, an ordering is evident which is of the very essence of teleology. Likes free to move tend to be associated, unlikes to be dissociated; unlikes held in association undergo modification and tend to become likes. There are many exceptions to this formula, especially in vital phenomena, where function often requires difference, and where associated unlike tissues and organs are needed for the work of the organism. But the rule which underlies them is universal, and is even implied in the exceptions themselves.

Most collocations of matter show the operation of the process by which likes are associated and unlikes dissociated. Gravitation itself is the placing of material things together on the ground of their likeness, the separation of matter from ether on the ground of their unlikeness. In the earth itself, omitting complications due to internal heat, the denser solids tend to move nearer to the center than the liquids; so the liquids take precedence of position over the gases; even the atmosphere shows a gradually diminishing density in the direction away from the earth. Roughly speaking, the bodies which make up our solar system occupy positions therein according to the degree of their density, the more dense planets moving nearer, the planets less dense farther away from the sun. That which is observable in our own system is also seen in cosmic systems: in most of the planetary nebulae and star clusters density increases from periphery to center; comets, densest at their nuclei, visibly diminish in compactness as their fan-like streamers recede; in meteor orbits the densest bodies travel first.

There is always a system at work, obviously or subtly, in acts of dissociation. An atmosphere overcharged with moisture literally expels moisture from itself, first into fine vesicles, later by the cumulative aggregation of these into the drops that constitute rain; so when the vapor of water issues from the spout of a kettle, the air which it traverses condenses into the droplets visible as steam. Water thrown on a dusty surface; molten lead let fall from a tower in the process of shot-making; melted glass dropped into water — all assume a more or less spherical shape under circumstances which suggest not only coherence by the like parts, but also repulsion by the unlike medium. Zinc and lead, or zinc and bismuth, may be melted together, but they separate more or less completely during the process. Chloroform and water may be mechanically mixed, yet when no longer shaken, the two fluids part into distinct layers. If upon oil placed in a receptacle water be poured, the water will displace the oil; if mercury be added, it will displace both oil and water, the final collocation — three layers occupying positions in the order of their density — being reached by a process involving both association and dissociation — association of the like parts of each layer, dissociation of the unlike layers.

How objects pass from systems from which they differ towards systems which they resemble may be seen by an experiment. Pour into a receptacle on the bottom of which a small cork has been placed a pound or more of small shot until the cork has been engulfed several inches. Shake the receptacle horizontally; the lighter object will presently rise to the surface. Use cork or wooden balls; place a leaden ball on the layer: the same agitation will now cause the heavier object to descend. This mimicry under new conditions of the familiar rising of " light " and the sinking of " heavy " bodies through water vividly illustrates the process by which an unlike is dissociated from a system made up of likes. And however the objects and circumstances may differ, the process is one with that by which the wrecked aeroplane drops to the earth and the gas-inflated balloon ascends.

Observe that things exist in great " together " systems of likes — ether and matter, earth, water and air. The foundation elements of all inanimate objects are likes to each other, as are the foundation elements of all living bodies. As defined by Pasteur, a chemical element " is a collection of individuals identical in the nature, the proportion and the arrangement of the elements." In other words, the molecule in each of the different kinds of matter known to us is built up in like manner with its fellow molecules. How, then, does it happen that these are often formed of unlike atoms — an apparent exception to the rule that likes are associated and unlikes dissociated? We must assume that the laws of chemical combination are due not only to the nature of the atoms, but also to the nature of the ether system as resisting conflict within itself, as striving towards the preservation of its own homogeneity. Atoms do differ from each other in composition and therefore in kinetic form: the problem, so to speak, is how their differences can best be harmonized. We see it solved, through whatever action of atom and reaction of ether, involving whatever complication of chemical and electric forces, by the compacting of the unlike elements into the larger units of likes called molecules. The working of power is towards the setting up of systems whose elements, being likes, conflict least with each other and with the larger system to which they are subordinated; and out of these simple beginnings of the process arise the higher complexities with which organic and vital chemistry deals. It is a drift away from differential stress towards equalized stress, away from change towards endurance. It reveals in the very foundation of material aggregates the process by which dynamic differences are automatically self-eliminated.

The view here taken that the ether, in resisting distortion, insisting upon its own homogeneity, unites into like molecules the superficially unlike atoms that vibrate unsynchronously or move in unlike ways within it, is not without meaning for electrical phenomena. Note the remarkable fact that all electrical currents and all production of electrical disturbances originate in what may be called the attempt to associate unlike kinetic values. We get frictional electricity by rubbing not like, but unlike substances together. Separative electricity demands difference for its manifestation, since no electricity is excited when two perfectly similar bodies are pressed together, yet electricity is evolved even when the substances differ simply in the matter of temperature. So thermo-electricity is generated at the junction not of like, but of unlike metals, or at the meeting point of metals one of which is "hot," the other "cold." For battery currents the use of unlike elements is indispensable; unlikeness is also a pre-condition of the production of electricity by means of "influence" and dynamo-electric machines.

Generally speaking, all these are cases in which unlike material units, compelled to oscillate in unlike ways in close proximity to each other, give rise to a more or less violent ether resistance — a resistance which is really a resistance to distortion, to the setting up of unlike conditions for ether areas whose nature it is to be likes, and it seems to be this resistance which, when not relieved by the chemical synthesis of the unlike atoms, finds reactionary manifestation as an electrical current. There is, in other words, a temporary storing up or accumulation of the resistance as a two-sided local distortion of the ether, and the resultant stream of electrons may be the violent recovery of the ether from such distortion. Thus the apparent exceptions to the law of assimilation suggested by electrical phenomena are really illustrations of that law.

The process by which likes are associated and unlikes dissociated or converted into likes is also illustrated in the realm of living things, for though organisms display numerous differences of tissue, organ and bodily process, these arise out of function, itself due to the enormous complexity of organic as contrasted with inorganic maintenance. We really have the same ground for believing that the living body is built up of units that are likes to each other, into whatever unlike structures they may be combined, as we have for positing like elements at the foundation of inorganic matter itself. Like activities require like units for their performance, and where such activities are imposed upon a group of elements, the assimilation to each other of such elements is inevitable. Hence also it is that food materials taken into the organic system — which is a community of cells, as the ether system is a community of power units — must submit to a likening process as a condition of their admission to association. Materials that cannot be assimilated are subjected to a process of dissociation.

More complex illustrations of the law, arising out of phenomena more complex, are furnished by societies of organisms, yet there also the resistance is greatest where there is association of unlikes, and least where the association is of likes. The most general example, including all others, is the universal distribution of organisms into genuses, species, varieties, and sub-varieties, beginning with the lowest forms of life and culminating in man. Appeal to a few representative cases will suffice to describe all cases. Describing a molluscan fauna in the Sandwich Islands, J. G. Gulick says: "We frequently find a genus represented in several successive valleys by allied species, sometimes feeding on the same, sometimes on different plants. In every such case the valleys that are nearest to each other furnish the most nearly allied forms; and a full set of the varieties of each species presents a minute gradation of forms between the more divergent types found in the more widely separated localities." (Cited in Wallace's "Darwinism," p. 147.) In the Falkland Islands, where the cattle have run wild, and where they are of several different colors, each color keeps in a separate herd, often restricted to one part of the island; among the wild horses of Paraguay those of the same color and size associate with each other; in Circassia three races of horses exist which, when living in freedom, always refuse to mingle and cross; on the Faroe Islands the half-wild, native black sheep resist attempts to breed them with imported white sheep; in the Forest of Dean and the New Forest the dark and pale colored herds of fallow deer have never been known to mingle; the merino and the heath sheep of Scotland, if the two flocks are mixed together, will each breed with its own variety; Ancon sheep have been observed to keep together, separating themselves from the rest of the flock when put into enclosures with other sheep; "the female of the dog" (says Professor Low, an authority on domesticated animals), "when not under restraint, makes selection of her mate, the mastiff selecting the mastiff, the terrier the terrier, and so on"; pigeons pair, when choice is free, with their own kind; flocks of white and Chinese geese, even when associated by the breeder, keep themselves distinct.

Many examples might be given of the resistance which the animal group offers to unlikes that appear within it. "I presume," says Galton ("Human Faculty and Its Development," p. 261), "that two species of animals do not consider one another companionable or clubbable unless their behaviour and their persons are reciprocally agreeable. A phlegmatic animal would be exceedingly disquieted by the close companionship of an excitable one. The movements of one beast may have a character that is unpleasing to the eyes of another; his cries may sound discordant; his smell may be repulsive. Two herds of animals would hardly intermingle unless their respective languages of action and of voice were mutually intelligible." Ants often eject intruding members of alien varieties; geese and hens drive away strange birds of their own species; crows and rooks expel wrongdoers from their midst; domestic pigeons attack and badly wound sick, young or fallen birds; beavers dissociate idle members from their colony; a wounded herbivorous animal returning to its companions is usually attacked and gored to death; elephants not only expel a "rogue" from the herd, but have been known to refuse refuge to one of their number which had escaped with the bandages of the capturer still on its legs.

Human societies display the same distributions, segregations, divisions — the same favoring of likeness, the same aversion to difference. The members of races and nationalities cling together in the same territories, and even when separated by exception "drag at each remove" their "lengthening chain" of sympathy and sentiment in common. When foreigners intrude into such societies they form colonies in country districts or "quarters" in cities. "Not even a common country," Count Gobineau reminds us, "can extinguish the hereditary aversion of the Arab to the Turk, of the Kurd to the Nestorian, of the Magyar to the Slav." And within the societies themselves there are subsidiary bonds that at once link and exclude — bonds of caste, class, occupation and interest, as was long ago implied by such names as "aristocrat," "commoner," "bourgeois," "official," "proletariat." "Each caste," wrote De Tocqueville ("Democracy in America," Vol. 2, pp. 149–150), "has its own opinions, feelings, rights, manners and modes of living. Thus the men of whom each caste is composed do not resemble the mass of their fellow-citizens; they do not think or feel in the same manner, and they scarcely believe that they belong to the same human race."

Facility of association is at its highest between men of like politics, of like faith, of like aims in any field of activity. Clubs of every kind constitute so many classes of likes within which the elements of resistance are at a minimum; it is likeness which explains the pleasure with which artists, scientists and literary men come together, and from which the camaraderie of the trades and professions draws its spirit. Even when men gather for only temporary and general purposes, even simply for social enjoyment, we often hear of religion and politics being tabooed as a means of avoiding the resistance of unlikeness — of bringing forward only those sides of human nature on which the associated individuals are for the time being alike. The poor find among the poor the greatest facility of relation with their fellow beings; so the possessors of wealth are usually most at their ease in intercourse with the well-to-do. Friendships are more common between people of like than of unlike age, as may be seen from the manner in which school children associate, younger and older seeking their likes. There is a similar ease of relation between people afflicted with the same disease or deformity. Deaf-mutes almost invariably marry deaf-mutes; it is by preference that the blind select the blind for comrades. Who has not witnessed how quickly two abnormally stout men enter into friendly relations with each other?

What we see in all these examples is the teleology of the universe process asserting itself, primordially in inorganic matter, then derivatively in the phenomena of life. Material units are associated by the differential stresses they encounter from the ether system insisting on its own homogeneity — on the association of its own likes, on the dissociation of its unlikes — and are dealt with automatically according to superficial likenesses and unlikenesses that arise among them — by association of the likes and dissociation of the unlikes, or by an assimilative process which modifies difference into likeness. Through the very nature of the motion process change is at a minimum where there is likeness, and at a maximum where there is difference. In both inorganic and organic, wherever unlikeness is not required by function, the differential stresses due to difference work automatically to set up the equalized stresses which result from likeness, and it is these equalized stresses which characterize the enduring, the teleological, the purposive forms that surround us everywhere in Nature and life. Later we shall observe the voluntary aspects of this process in the activities of man, even in the method by which in mental phenomena the mind brings its likes together and dissociates or assimilates its unlikes. Exceptions to the rule abound. But beneath all the accidental or planned juxtapositions of unlike things in the natural and human environment, wherever Nature is at work or man contrives, there enduring forms are set up, there purposiveness is in evidence, and there its teleology triumphs over the actions and reactions of units which, though always something for themselves, are eternally subordinated to a universe which is all for itself.

CHAPTER XXIII

DISTRIBUTIVE ASSIMILATION

There are two general aspects of the process by which conditions of differential stress, the result of unlikeness, find their goal in conditions of equalized stress. In one of them likening is associative, in the other distributive. It is associative when matter units are thrust towards each other, as in gravitative and chemical action; when superficially unlike groups are combined into larger groups of likes; or when there is modification of associated unlikes into likeness. The process is dissociative where unlikes are separated, or where bodies are distributed more or less equably through a system. Assimilation on a scale cosmic as well as minute is seen in the diffusive equalization of conditions. Note the assimilative distribution of heat through liquids by means of convection currents: as the surface of the sea becomes cooled in winter, the cooler layers sink and are being continually replaced by warmer water from below. Vertical exchanges of temperature also take place between higher and lower layers of the atmosphere; the difference of temperature between the polar regions and the equatorial zone results in the assimilative movement known as atmospheric circulation. As ocean currents, like the Gulf Stream of the Atlantic, the Kurosivo of the Pacific, carry heat from the warmer to the colder regions of the earth, so air currents arise out of those differences of heat and of barometrical pressure which it is obviously their function to remove. All atmospheric movements, whether local or general in character, are either movements of direct assimilation or disturbances arising indirectly out of such movements. And it is only because differentiating influences are continually at work that the equalizations set up are continually being unmade; that we have cyclones and anti-cyclones, tornadoes and blizzards, land and sea breezes, mountain and valley winds, sand spouts and dust whirls; that there are "cold waves" like those of the United States, and warm winds like the Foehn of Switzerland, the Sirocco of the Adriatic; that periodical and more or less local atmospheric disturbances occur all over the planet, such as the Mistral of Provence, the Harmattan of the west coast of Africa, the Leveche of Spain, the Khamsin of Egypt, the Buran of the deserts and steppes of Central Asia, the Bora of Trieste and Dalmatia, the Pamperos of the Brazilian coast, the Purga of the Yenisei, and the Nortes of the Gulf of Mexico.

There is assimilation, both in form and speed, of the motion of associated electrons, atoms and molecules in the phenomena of heat and electromagnetism. Ever since the days of Gilbert the power of a magnet to produce magnetism has been familiar; a still more striking example is furnished by the action known as induced radio-activity, for when solid bodies are placed near a salt of radium they acquire its radiant properties. When volumes of different gases are introduced into a closed receptacle all the assembled molecules acquire the same kinetic energy. Heat communicated to an aggregate is more or less rapidly distributed through it until all the parts possess, roughly speaking, like amounts of motion; a mass of metal heated in a furnace becomes gradually assimilated to the character of its surroundings; by a process apparently different, but fundamentally similar, the earth radiates energy into the atmosphere and suns diffuse their heat into so-called space. Maxwell ("Elementary Treatise on Electricity") noted that if two vessels containing the same or different fluids are put into communication by means of a pipe, the fluid will flow from the vessel in which the pressure is greater into that in which it is less until the pressure is equalized. Similarly, if two electric bodies are connected by means of a wire, electrification will be transferred from the body at higher to the body at lower potential.

There is an equalizing distribution of bodies as well as of their conditions. After molecules have been compacted into apparently unyielding aggregates, particles of such aggregates are being continually given off into the atmosphere. There are reasons for believing that all matter is "radio-active," and that were it not for the tremendous force of the associative inthrust, intensified by the conditions of chemical action, all matter units would be diffused through the ether system. The odor given out by most bodies, even by metals — more perceptible in the case of liquids than in that of solids, and in the case of high than of low temperatures — sufficiently testifies to a diffusive action which, however held in check, cannot be wholly prevented. Liquefaction of a solid by heat is but the incipient stage of a process which, were it unresisted, could only end in universal diffusion. The rapidity with which the vapor of ether, or the fumes of tobacco, are diffused is a matter of familiar experience. "If a bottle of any odorous gas be opened," writes W. A. Tilden ("Chemical Philosophy"), "in any part of a room at constant temperature and free from draughts, the smell of the gas soon becomes perceptible in every part of the room, and after the lapse of a short time equably in every part of it." Gases, when brought together, permeate each other in such a way as to give rise to a tolerably like constitution for every larger or smaller area of the total volume. Gas distributes itself equably through liquids, as in the case of effervescing drinks; solutions of salts brought into contact with each other finally intermingle. A soluble solid, when introduced into a liquid, usually assumes the liquid state to the extent of the capacity of the fluid for taking it up, as in the familiar case of sugar in tea or alum in water, while the liquid itself undergoes modification by the equable distribution of the particles absorbed. The uniform hardness of "hard water," due to the presence of bicarbonate of lime, and the uniform tenacity of solutions of soap in water, are seen in experiments with soap bubbles, both showing how equably substances held in solution are diffused. The evaporation of fluids into air, like the dissolution of solids in water, is in results, at any rate, a case of assimilation to the character of the surrounding or adjacent medium. The mixing of metals also illustrates the process of distributive assimilation, for whether it produces amalgams or alloys — whether the mixture be a merely mechanical association of the parts brought together or a chemical combination of those parts — the fact remains that for given areas, which may be large or small, the average degree of diffusion is always the same. This is shown with especial clearness in those compounds of carbon and manganese with iron, of copper with phosphorus, and of arsenic with many of the metals that are utilized for various industrial purposes: none of such compounds would have their commercial value were it not for the fairly uniform diffusion through the metal modified of the substance employed to modify it. Nor is the molten state a necessary pre-condition. In a well-known experiment Sir W. Roberts-Austen placed pieces of gold and lead in contact at a temperature of 18 degrees. After the lapse of a year the gold had traveled into the lead to such an extent that not only were the two metals united, but on analysis appreciable quantities of the gold were detected even at a distance of five millimeters from the common surface, while within a distance of three-quarters of a millimeter from the surface the gold had penetrated into the lead to the extent of one ounce three pennyweights per ton — an amount which could have been profitably extracted.

With our thoughts intent on the equalization of differentials by means of diffusion we naturally turn to the ocean. Chateaubriand, in his "Memoirs," describes it as a highway "without trees, villages, towers, steeples, tombstones," as "a road without posts or milestones, which has no boundaries save the waves, no relays save the winds, no lights save the stars." It is true that, unvexed by the blast, as on calm June days, the sea smoothes down into something like monotony, yet its cunningly worked mosaic of surface detail, woven small or woven large, is always in evidence. How this pattern comes to be set up, yielding equal conditions for equal areas, is especially well seen on days succeeding storm, when the raised masses of water are falling towards their normal levels. Everywhere differential stress is at work. Waves rising above the average level have their excess of power, of motion, carried off in the excessive reaction of the adjoining waves; valleys descending below the average level invite the excessive reactions by means of which the heaped-up motion is gradually diffused. Action everywhere produces a reaction like in amount; the restress gives rise to an equal stress; reaction again follows action; and thus, through this never-suspended reciprocality, the local excess is passed on until it has come to be equally shared by the whole of the interrelated areas. The phenomenon is the same whatever the scale on which water waves are assimilated to each other: in pond, lake or ocean, breeze-stirred or wind-driven, elimination of differentials is the process and uniformity of pattern the goal.

Sooner or later we lift our eyes from the many-faceted waters to the heavens that brood over them with the thought borne in upon us that in some way there must be community between the waves that chase each other to disappearing on our own planet and the flowing tides of "protyle" out of which the cosmos weaves the patterns of our midnight skies. In compacted clusters and condensing spirals, in stellar binaries and far-divided suns, in scattered spots of shining vapor and luminous wreaths that girdle the firmament, the story of celestial assimilation reaches us, with plain evidences of an association and a dissociation that do not exclude each other but meet and mingle. That which happens in the ocean, as a progressive interassimilation of surfaces agitated normally or abnormally, takes place just as perpetually, though on a vastly larger scale, in the cosmos at large. As the ripples produced in a pond by the wind or by a falling object chase each other over its surface, returning and rereturning from the banks which reflect them until the disturbance is more or less equably distributed; as the sound waves in air created by a volcanic explosion, such as that at Krakatoa in 1883, circle the earth, rebounding and returning again and again until their motion has been shared by all the areas of the atmosphere — so is the motion we call heat and light passed on through the ether system. All such waves are in a sense self-distributive: as stresses greater than the average they call for greater than average reactions, and it is through these reactions, themselves functioning as new stresses, with restresses above the average for their complements, that the abnormal conditions are finally diffused. There are too many cross-currents of influence, too many fortuities of disturbance, to permit of a final and equable distribution. But the drift towards such equable diffusion is unmistakable.

That the associative process has opposed to it some incidence of distributive action that holds gravitating bodies apart is as eloquently suggested by stellar configurations as by the enduring separations of our own solar system. Our feeling is that in a universe wherein all material objects are impelled towards each other, some influence beyond that of "centrifugal force" must be at work to keep stars and star systems asunder. Some reason there must be, aside from vastnesses of space and time, impressive as these are for the unchangingness of arrangement which has rendered the starry heavens familiar as well as dear to us, and still yields unaltered to our human vision the shapes of beauty that do not pass from our intellectual life when Arcturus sinks in the north, when the Great Bear wheels to eastward or westward, when summer banishes Orion, or when winter no longer crowns the dizzy heights with the steely radiance of Vega. Not only do the constellations return to us continually as our race has always known them — they face us just as continually with that tantalizing average of distance, as it may be called, which is one of the most mysterious aspects of the night sky. We float on the trackless ocean of our own planet for days, weeks, months, but the revolving screw and the churned sea at last bear us within sight of objects that grow in size as we approach them. In sight of what nearing shore does our infinitely vaster and swifter ether voyage ever bring us? Sun-tugged through space, along straight line or curved line, do we ever really draw nearer to the objects which seem almost to congeal us as they shine with the thought of their frigid inaccessibility? With the earth, it may be, from hundreds to thousands of millions of years old, and the sun itself moving at the rate of at least 400,000,000 miles a year, how happens it that gravitation has done so little to change our own average distance from the stars and their own average distance from each other? We have theories of stellar evolution by collision, and a fascinating hypothesis showing how, from a war of all against all in the heavens, dead suns are re-made and re-illuminated. Yet nothing like satisfactory evidence of such a process has been vouchsafed to us. According to the estimate of Harvard astronomers ("The Universe of Stars," 1926) there are 50,000,000,000 stars in the accessible universe. The average speed of these bodies, as estimated by

Kapteyn, is about twenty-six miles a second, while for some of them the speed attained ranges from 150 to 500 miles a second. Now if collision be the method of stellar rejuvenation we ought to see more "catastrophes" in the heavens. In "The System of Stars" (Clerke) there is a list of ten novae or "new stars" appearing from B.C. 134 to the end of the fifteenth century, representing an average of one in every 160 years; the circulars of Harvard University record sixteen such novae from 1572 to 1901, and a far larger total since observations of such objects began. Yet not one of these appearances is definitely known to have resulted from collision; they have presented themselves to us as more or less sudden up-blazings of whose immediate cause — beyond the suggestions of rival hypotheses — we have positively no information. The fact that the earth, moving with the sun for thousands of millions of years at the rate of 400,000,000 miles annually has been absolutely safe-guarded from collision with other cosmic bodies large enough to injure it, and has been thus safeguarded through the vast geological periods that have gone to the making of man, gives reasonable presumption of a similar relative immunity enjoyed by most other stellar and planetary bodies. Says Newcomb ("The Stars"): "All the facts reviewed lead to the belief that, out of a great distance, the stars are scattered without any great and well-marked deviation from uniformity. This belief rests upon the remarkable equality in the number of stars in opposite directions from us" (p. 315). "Outside the galactic region the stars in general show no tendency to collect into systems or clusters, but are mostly scattered through space with some approach to uniformity" (p. 320). And as this uniformity cannot be regarded as something peculiar to our period of cosmic history, the reference of it to a process which has equalization by distribution as well as equalization by aggregation for its goal is inevitable.

The process so clearly manifest on the earth, shown in physical, chemical and also, as we shall presently note, in vital phenomena, is thus also operative in the universe at large. All the while a kind of conflict between aggregative action and separative action is plainly in evidence. If the one had full sway, all matter in the universe would rush together, and only a single material body would exist; were the other alone operative, material units would be equably diffused throughout the ether system. What we see seems like a compromise between the aggregative in-thrust and the separative out-thrust — between the accumulation of matter and motion into the centers we call objects and the more or less equable diffusion of them and of the systems which they form. Yet in the one case and in the other differential stress is the immediate agency at work, while behind and beneath both aspects of the process, making them one, is the cosmos, producing unlikeness, yet working towards likeness, setting up the arrangements as well as the forms most fitted to endure, securing the motions and configurations which disturb its homogeneity the least — in a word, maintaining itself.

CHAPTER XXIV

THE SOCIAL FACTOR IN ASSIMILATION

A SOCIETY, while tolerating the superficial differences needed for function, insists on the fundamental likenesses which are required for coöperation. The closer the relations between its members, the more vigorous is this insistence; the more numerous the individuals, the greater is the power exerted to insure likeness between them. Perhaps the most important life-step in society-building was that taken when, by the change from agamic to gamic reproduction, sex came into existence. The organism had previously obtained continuance by simple division of itself, the products of division dividing in turn. All these reproductive germs had their inheritance exclusively from the past: they were loosed from any internal subordination, whether of let or hindrance, to the contemporary organisms of their own kind. But when for the perpetuation of the species the union of two individual organisms became necessary, the time inheritance was supplemented by a sort of space inheritance. Free crossing of individuals, the so-called panmixia, now widened the basis of the organic structure by connecting individual with species in a way not possible before. It delivered each organism from adaptation to its own narrow environment into adaptation to the larger, the species environment. By the mingling of two individuals it increased the possibility of variation, but it also worked to generalize variations and thus render them less isolating. It subordinated the individual to a society and brought a society to the aid of the individual in a degree not attained under agamic reproduction. And it made possible on a larger and more efficient scale that coöperation between social units which their essential likeness alone makes possible.

In the higher animal societies the action of the social milieu in assimilating individuals to each other is conspicuously seen. "We constantly modify our memories," says James Mark Baldwin ("The Story of the Mind," p. 142), "to agree more closely with the truths of social belief, paring down unconsciously the difference between our own and others' reports of things. If several witnesses of an event be allowed to compare notes from time to time, they will gradually come to tell more nearly the same story." And writing of the manner in which public opinion impresses individuals, John Henry Newman says in "Historical Sketches" (p. 3): "Too often it is nothing more than what the world opines, and not any one in particular. Your neighbor assures you that everyone is of one way of thinking; that there is but one opinion on the subject; and while he claims not to be answerable for it, he does not hesitate to propound and spread it. In such cases everyone is appealing to everyone else; and the constituent members of a community one by one think it their duty to defer and succumb to that same community as a whole. . . . Public opinion especially acts upon the imagination: it does not convince, but it impresses; it is the force of authority rather than of reason; and concurrence in it is not an intelligent decision, but a submission of belief."

The subordination of the individual to a system is seen in the resistance which is offered to non-conformity in social manners, as when guests take up more than their share of the time or attention of the company, or when prescriptions of ceremonial etiquette are neglected. It is the social stress impelling to likeness, not the character of the act itself, which makes a man running in the street look undignified, a woman still more so, because in her it is more unusual. The fear to be seen carrying a parcel has been known to increase with the degree of personal eminence in the social, political, literary and scientific world. There are haunts in the cities of Great Britain and other European countries into which no well-dressed person can penetrate without encountering hostility; the attacks sometimes made upon strangely attired foreign dignitaries in China have had occasional parallels in the highly progressive countries. "There are parts of France," says Hamerton ("Chapters on Animals," p. 90), "where it is already thought an eccentricity to ride on horseback, and where pedestrians are so rare that if ever one makes his appearance the children stare and laugh, and the grown-up people smile, as they would at a man on stilts. In neighborhoods of that kind it is dangerous to a man's reputation for gravity to be seen on horseback, and men of serious pretensions have the same objection to the saddle that a bishop has to a bicycle."

This intolerance of the social system for units unlike its own is not lessened, but rather increased, by the complexities of industrial organization. The civilized being who enters a savage community will be compelled to go half naked through very lack of the means whereby clothes are produced; he will be forced to hunt or fish for a living for the reason that there is yet no coöperative method of supply in existence: in the absence of industry and industrial functionaries he must become his own soldier, his own farmer, his own doctor, and must carry on their activities, however crudely, for himself. So a savage entering civilized society will be compelled to wear clothes, partly by social intolerance of nudity, partly because of the existing facilities for making clothes. There will now be no game to pursue and no need to pursue it; he will lose his many-sided capacity, for he will have an army of stock-raisers, farmers, tailors, shoemakers, house-builders and doctors at his service; in time, moreover, society will impose, in place of the powers which it abstracts, new functions and activities assimilating him industrially to the units of which it is already composed. It both cases likeness will be enforced by the resistances offered to unlikenesses, and not by any inherent superiority of one system or by any inherent inferiority of another: savages who have not yet learned to coöperate are as much held to their rude industrial methods by the stresses that impel to likeness as civilized men are held by such stresses to the vastly more complex and highly organized activities of the modern society.

Where the unlikes are not modifiable, either owing to the brevity of contact, or as a result of differences which the assimilative process cannot reach, the social system associates the unlikes either within or without itself. The simplest example of this simultaneous association and dissociation is shown where a social gathering breaks up into groups, the movement being one from associations which involve the greatest resistance to associations which involve the least. " Put any company of people together," says Emerson (" Society and Solitude "), " with freedom for conversation, and a rapid self-distribution takes place into sets and pairs. The best are accused of exclusiveness. It would be more true to say that they separate as oil from water, as children from old people, without love or hatred in the matter, each seeking his like." The same phenomena were observed by Schopenhauer (" Paränesen und Maximen, Unser Verhalten gegen Andere Betreffend "):

> It is astonishing how quickly homogeneity and heterogeneity of mind and character between men announce themselves in conversation. It is revealed by every triviality. . . . Thus it is that in the case of individuals who are essentially unlike each other nearly every sentence uttered by the one must more or less displease the other. . . . Likes on the contrary feel at

> once and in everything a certain agreement which, when the likeness is great, soon melts into complete harmony, even unison. This explains why quite ordinary people are so sociable and everywhere find such excellent society — such honest, brave and genial people. . . . The like-minded come together as quickly as if they were magnetically attracted to each other. . . . So in a great gathering of people met together for practical objects two rogues will recognize each other as if they wore badges, and will at once come together to plan misdeeds and treachery. In a society of highly intelligent and intellectual people two blockheads will feel sympathetically drawn to each other, and each in his heart will rejoice that he has found at least one rational human being. It is really remarkable to observe how two individuals, especially from classes that are morally and intellectually inferior, recognize each other at the first glance, eagerly seek to approach each other, and come together with such manifestations of joy as might lead to the supposition that they were old acquaintances: so striking is it that one is tempted to believe, in accordance with the doctrine of the transmigration of souls, that they were friends in some earlier existence.

Nor is the stress impelling to this kind of segregation always voluntary. As a group of men surrounded in battle by a larger force naturally closes up and is compacted for defense by the stress of those who attack, so the individual members of classes or races despised, hated or feared are in like manner thrust in and welded together by their hostile environment. Individuals, again, who differ from their fellows to the extent of being unable or unwilling to work — to take part in those coöperative activities which are necessary for both individual and social maintenance — meet with the resistances which such failure involves and come to be separated from the rest into hospitals or poorhouses; so men whose actions are unlike those of others beyond the amount of difference permitted by law are dissociated, either by exile or imprisonment, from the communities which they injure. When expulsion of the unlike is not practicable there is association of them as prisoners within the system. Savages often abandon or destroy individuals deformed at birth or incapacitated from social duties by age; even a people like the Spartans exposed their weaklings to death by starvation. That there is still a tendency to offer undue resistance to the unlikenesses of physical and mental deformity is shown by the occasional inhumane treatment of lunatics and criminals in the most civilized countries; not many years ago positively cruel, it is still in many cases culpably careless and inadequate. Similarly inhuman treatment of the lower animals; offenses against the helplessness of women and children; the oppression of individuals by autocrats, by governments, by official tyrants abusing delegated power; by capitalists taking unfair advantage of labor, and by organized labor ignoring the problems of capital — these are all cases of stress directed against unlikes. So human shortcomings of every kind are in numberless ways made the goal of individual or social stress; even ridicule and slander are forms of aggression based on the real or fancied discovery of fault, and therefore of difference, in the person assailed.

There are temporary forms of the social stress which work for assimilation. We note them in the unifying effect which the wearing of a common badge or uniform has upon large bodies of men brought together for special ends. In moments of exaltation or depression, as in the excitement of conflict or intoxication, under the influence of music or religious worship, the differences of more permanent states lose their separative power, and men come into unwonted facility, even pleasure of relation with each other. It is supposed that even between deadly enemies chancing to meet at the dinner table there passes a flash of momentary reconciliation. It is certain that shipwrecked men do not quarrel over politics, that the starving are usually free from religious bigotry, and that in the presence of a general bereavement the clamors of faction and the prejudices of class are silent. The power of war and of the comradeship of battle to annihilate distinctions usually recognized in time of peace is notorious. In all these cases we see great importance suddenly given to some all-absorbing feeling under the influence of which men superficially unlike come together as fundamentally like each other, the differences which separate being merged in the wider likenesses that unify.

The social intolerance of unlikeness is widely seen in educational processes, as well as in numerous reform movements. It is shown with especial significance in the "social unrest," — in the widely diffused passion for equality among men — in the tendency, vaguely or vividly felt, to insist on it that those with whom we come into contact shall in as many respects as possible be likes of ourselves. Jealousy of special privilege, with its spirit embodied in such phrases as "fair play," "start equal," "share and share alike," "a fair field and no favor," begins to manifest itself early in the life of the individual: mere children, when associated, insist in multifarious ways on likeness of treatment; anything like favoritism in the distribution of gifts or the bestowal of attention, as well as all unfair advantage in games, they resent with promptness, vigor, even with indignation. In adults this jealousy of unequalness finds expression over a much wider field; nor is it an exaggeration to say that the desires of modern men and women are determined much less by the things which they lack than by the things which they know other people to possess. That it is regarded as fair, as well as found to be convenient, to treat alike all bodies of men subject to the same general conditions, may be seen in the regulations for factories, hospitals and prisons, in by-laws for cities, and in general laws framed for communities and nations, even in the body of rules which has grown up under the title of international law, all these being means of preventing unlike and promoting like acting between the individuals and communities associated. The sense that men should be politically as well as legally equal; the demand always made, if not always satisfied, for universal suffrage, first for men, then for women — at first with limitations of race, property, or sex, then without such limitations — indicate the same working of the social system towards the assimilation of its units and therefore towards the setting up of conditions of maximum ease within itself. It is for like reasons that, more or less consciously, more or less outspokenly, men aim at a common degree of well-being for all the members of the community, and regard inequalities of wealth, even of industrial power, as imperfect stages of human development that are to be outgrown. Hence it is that they denounce monopolies and declare abnormally large accumulations of wealth in private hands to be inequitable; hence, too, that in the common jealousy of privilege there is to be found every form of hostility to exceptional social power and rank, from the dislike in which it is merely envied to the anger in which it is openly attacked. Socialistic schemes of reform are really schemes for diminishing those inequalities which still offer resistance to the association of men — means for making them in social, political and legal relations, in powers, conditions and responsibilities as nearly as may be likes to each other. Even religions illustrate the progress from a belief and acquiescence in special privileges held out to a favored few to an expectation and demand for the salvation of all; so if the pagan had to content himself with the satisfaction of knowing death as the universal leveler, asking with Cicero ("Tusculan Disputations"), "Can what is necessary for all be a source of misery to one?" the Christian, who claims the equality of all men before God, looks forward to a life hereafter in which all earthly unlikenesses are to be removed.

CHAPTER XXV

LIKENING AS IMITATION

Many likening processes in human society, some voluntary, others involuntary, have traits sufficiently common to be classed together as imitative. "Persons cutting anything with a pair of scissors," wrote Charles Darwin ("Expression of the Emotions in Animals and Man," p. 34), "may be seen to move their jaws simultaneously with the play of the scissors. Children learning to write often twist about their tongues, as their fingers move, in a ridiculous fashion. When a public singer suddenly becomes a little hoarse, many of those present may be heard, as I have been assured by a gentleman on whom I can rely, to clear their throats. . . . I have also been told that at leaping matches, as the performer makes his spring, many of the spectators, men and boys, move their feet." All who have watched billiard matches must have observed the strange contortions sometimes made by the spectator when the player is "making his shot," or in the so-called cannon game when a lagging ball is "assisted" in a ludicrous manner by the onlooker. Says Lotze in his "Medicinische Psychologie": "The spectator accompanies the moving of a billiard ball, or the thrust of the swordsman, with a slight movement of the arm; the untaught narrator tells his story with many gesticulations; the reader, while absorbed in the perusal of a battle scene, feels a slight tension run through his muscular system, keeping time, as it were, with the actions of which he is reading." To what an extent individuals read about may be imitated is suggested by Guyau ("Education and Heredity," p. 15) in the statement that he knew a child of thirteen who read in "Martin Pax," one of Jules Verne's novels, the description of a captivating heroine with a mincing gait, and that from that time forward the child endeavored to take very small steps. According to Lavater ("L'Influence Réciproque des Physionomies") even features may become assimilated: "*Il arrive à tout le monde de prendre les habitudes, les gestes, la physionomie de ceux qu'on voit familièrement. Nous nous assimilons en quelque sorte tout ce que nous aimons.*" And in the preaching scene of "Adam Bede" George Eliot writes: "Every generation in the village was there. . . . Now and then there was a new arrival; perhaps a slouching laborer who, having eaten his supper, came to look at the unusual scene with a slow bovine gaze. . . . Villagers never swarm, and they seem as incapable of an undertone as a cow or a stag."

Guyau also reminds us that individual may be temporarily assimilated to individual by hypnosis. "If we ask the neuropath to look attentively at the motion of flexure given to our hand, in a few minutes he declares he has a sensation as if the same movement is taking place in his own hand, although it is perfectly motionless. But this immobility does not continue, for his hand very soon begins to carry out the rhythmic movements of flexion. . . . The neuropath who tends mechanically to reproduce muscular movements executed in his presence will equally tend to reproduce a state of sensibility or volition which he sees in another individual, and which has been revealed to him either directly by facial expression or indirectly by speech and the tone of the voice." Two cases of assimilative action through sympathy are mentioned by Dr. Hack Tuke ("Influence of the Mind on the Body in Health and Disease," p. 17): in one a lady suffered intense pain, accompanied by the development of a red mark on her ankle, through seeing a child in whom she was greatly interested in danger of having its ankle crushed by an iron gate; in the other a lady's lips and mouth swelled to an enormous extent through seeing a child pass the sharp blade of a knife between its lips. The impressionability of an audience to emotions portrayed on the stage is well known, and the members of all audiences influence each other by suggestion — in yawning, coughing, applauding: the mere shifting of a chair or an audible change in the position of the body gives rise to other movements of the same kind. If in a thoroughfare a man be encountered staring intently at some area of the sky, most of those who see him will at once direct their gaze in the same direction. Among people associated for work or social intercourse a mood of cheerfulness or depression in one of them easily communicates itself to the others; the power of good temper to reproduce itself is well expressed in the saying that "a soft answer turneth away wrath."

Assimilation is sometimes of morbid states of mind and body, and there is a propagation of these which resembles contagion. It is recorded in the "Journal des Connaissances Medico-Chirurgicales" (Feb. 16, 1851) that "in a workshop where sixty women were at work one of them had a nervous attack. Her companions pressed round her to assist and had no sooner done so than first one and then another fell a prey to the same kind of attack." In the fifteenth century a mewing mania in several convents in Germany was propagated among the inmates by involuntary imitation; in 1613 violent muscular contortions resembling epileptic fits spread among a number of women in the district of Ammon; and there is the record of a barking mania among women in the same year. The disorder known as "theomania," in which people believed they were influenced by God, raged in several parts of France from 1679 to 1696, and in the Protestant countries from 1521 to 1592: "the manners of these enthusiasts," says Brueys, "spread with such rapidity throughout that unfortunate country that the flames of a conflagration driven along by the winds is not more quickly communicated from house to house than this insanity flew from parish to parish." The "flagellation mania," which prevailed in Hungary and Germany, was similarly contagious; so were the proceedings of the Piagnoni in Florence, of the Patirini in Milan, the Lollards in Germany, the "convulsionnaires" of Paris, the Anabaptists of Holland, and in some of their vagaries, the revivalists of North America. Stockholm had its "Magdkrankheit," or preaching epidemic, in 1842; in 1887 more than 3,000 people assembled in the Alpine village of Montenero as the result of an epidemic delirium caused by the announcement of the second coming of Christ. The dancing mania, which began at Erfurt in 1237, appeared in Germany about the year 1374, and later at Strasburg in 1418, was a convulsive disorder in which the victims believed they were possessed by demons, and their ranks were "kept up by constant accessions, either of those who became eventually affected by the imitation and contagion of familiar intercourse, long continued, with the frenzied multitude, or with friends and relatives of the afflicted who followed from motives of affection and who, by force of sympathy, were drawn within the influence of this powerful delusion." Similarly contagious were the migratory epidemics of the middle ages — the *en masse* movement to Rome in the year 1300, the so-called Bianchi pilgrimages also in Italy, and the Crusades themselves; even in our own day Russia has had its "bare-foot brigade," America its "Coxey's army," and modern pilgrims still tramp to the shrines of India or seek the holy cities of the East.

Popular credulity easily passes into the contagious phase, as under the ancient delusion that persons of both sexes can have commerce with demons: hence the powerful influence and widespread occurrence of the witchcraft mania, which at one time raged throughout Europe and the United States. Results hardly less terrible have resulted from contagious spread of the notion that the water and food supplies were being poisoned. As early as the time of Thucydides the Peloponnesians were accused of poisoning the wells on the occasion of a plague in the Piraeus. Manzoni in "I Promessi Sposi" describes how, during the great plague in Milan in the year 1630, the notion took firm hold of the popular mind that the scourge was being propagated by means of ointments, powders, sorcery, or all these combined, saying that "with their minds already filled with the idea, the people who were merely told about it believed it as firmly as if they had witnessed it with their own eyes" ("*Quando gli animi son preoccupati, il sentire faceva l'effetto del vedere.*" Chapter 32). A plague panic took place in the St. Petersburg of 1831, and another in the Paris of 1848. Panics of suspicion, such as those from which the Jews have suffered, and panics of fear, well illustrated during the Indian mutiny, shade insensibly into panics of desire and exultation. Fear shows itself in the commercial panic: the least rumor will send crowds to the banks where their hard-earned savings are believed to be in peril. There are panics in which the "haste to get rich" is contagiously propagated, as in the Law ferment of the France of 1715–20, the notorious South-Sea Bubble, and the Mississippi and Panama Canal enterprises. That there are panics of "murder mania," showing the propagation of a lugubrious interest in great crimes, may be seen from the sudden and extraordinary rise which they produce in the circulation returns of popular newspapers. Contagious also is the belligerence mania, partially manifesting itself in the crowds which gather to obtain the results of some "great" prize fight, assuming national dimensions and the genuine war fever only when a reluctant government has to be bombarded into declaring war against a nation with which it is at peace. Then there are the milder delusions of belief and predilection which get themselves disseminated in the same way. That there is an element of imitation in spiritualism and the so-called " mind cure " cannot well be doubted. All " fads," from " tulipomania " to the passion for collecting *bric-à-brac* — from the desire to take physical exercise according to the newest system to the sense of satisfaction with which people announce to friends that they themselves have the malady which happens for the moment to be fashionable — belong to the class of affections that pass imitatively from mind to mind until the whole community is more or less assimilated. As a remarkable exploit in athletics usually sends a fever of emulation through sympathetic members of the social group, so a fashion set in literature, science or philosophy inspires a host of imitators. Even phrases become fashionable, and when there is nothing else to engage attention " popular " songs, even " popular " catch-words pass from mouth to mouth.

The manner in which authority imposes conformity and the desire for advantage leads to compliance finds abundant illustration in the narrower form of fashion which dictates dress. Usages in wearing apparel have been imposed authoritatively either by the individual or the society of individuals, since the beginning of civilized life; for an equally extended period such usages have been propagated by contagious assimilation. As there is scarcely an article of attire, worn either by men or women, which has not gone through endless changes of shape, size, material and color, so there is scarcely an incident of court, professional or social life which has not supplied the incentive to popular taste in dress. In this subordination to fashion two aspects may be recognized — a superficial aspect in which the craving for novelty shows itself, and a fundamental aspect wherein, beneath the desire for change, there is manifested an irresistible impulse towards resemblance, towards likeness, towards the imitation of others. To say that people imitate those whom they respect, venerate or fear — some monarch, social favorite, "reigning belle," or actress — is simply to say that they seek to gain the advantages which result from likeness, to avoid the disadvantages which result from difference. Whatever the immediate motive may be, the real reason is that they are brought into likeness with others by a stress which impels them into conditions of minimum difficulty, of maximum ease — a stress which makes them eager, as it were, to become like the members of some smaller or larger group, and thus to feel that sense of completeness which unification with the group always confers. In the inanimate world of physical action the impulsion which compels units to take on the forms of their associates is a highly simple and direct process; in the world of human activity it is complicated by human consciousness and will. Yet in both cases there is fundamentally the same impulsion towards the direction of least stress, away from the direction of greatest stress.

That there is an actual impulsion to compliance with human fashions in dress, however complex its incidence may be, is shown all through the literature of the subject by the use of such terms as imply command, dictation, decree, rule, reign, even tyranny. "One of the articles of personal adornment in old Rome," says Bruno Köhler ("Allgemeine Trachtenkunde," Reclam Edition, Vol. I, p. 192), "was an iron finger ring. Until the time of Pliny it was worn by all Roman citizens. The first gold ring ornamented with an intaglio is said to have been used by Scipio Africanus, but soon all the citizens followed suit. Even during the last century of the republic there could not have been found in all Rome a single citizen who did not possess a small collection of such rings. Fashion demanded that the rings should be worn in alternation." "A man of the court is not respected," wrote the secretary of the Venetian embassy during his residence in the Paris of 1577 (Weiss, Vol. 3, Pt. 2, p. 564), if he has not at least 25 or 30 costumes of different form, and does not change his dress every day." A tract cited by Fairholt asks: "What gentleman now rolls his stockings, or lets his breeches cover the cap of his knee? Who suffers his coat skirts to hang low enough to hide his thighs? Or who dare bear now with high-top gloves? Are not, even on the stage, full bottoms discouraged? Nay, a brigadier is unseemly; the scratch usurps the throne of longbobs, and a tye-wig is banished for a pigeon-winged toupee." Says Julius Lessing ("Der Mode Teufel"):

> Fashion is tyrannical as regards both men and women. Should it be the proper thing to have the sleeve without cuffs, a sleeve which has them excites a commiserating smile; should the fashionable overcoat button up high, broad flaps seem ridiculous. . . . Once royalty, after thorough consultation, has accepted a model uniform, it lies on the army clothing department like an iron rule. Every button, every seam is regulated. Yet in spite of all, fashion continues to play with the details. After the caps have been worn low for a time, it occurs to those regiments of the Guard which set the pace to make their caps unlike the rest. Let the caps in their club-house grow high, and at once the caps in the other club-houses and barracks of the metropolis follow suit; soon the officers in the provinces wear their caps high. . . . It is the same with the rows of buttons, which are now sewn on in parallel lines, and now made to narrow down towards the waist.

"The reign of fashion," observes Köhler (Vol. 1, Pt. 1, p. 11), "has lasted until our own day. Its sphere of influence has extended over the whole world. All civilized peoples bend before it in the dust, and meekly accept its capriciously alternating commands."

Beneath the surface fashions in dress which change from season to season, showing assimilation dominating variation, are the more deeply grounded but by no means enduring fashions of rank, social class or official position; of tribe, nation and race. Among the most advanced peoples uniforms appear to a diminished degree as signs of membership in the learned professions, or are confined to military, naval, ecclesiastical, judicial and other civil functionaries. To-day it is as difficult to distinguish an engineer, an architect or a college professor from a physician by dress as it was easy in the last decade of the sixteenth century to recognize the man in the long trailing robe as a schoolmaster, or the friend in red whom he met in the street as a doctor. Student uniforms such as still linger in Germany and Russia have completely disappeared from the United States: they resemble inflections of language that have served their purpose, and tend everywhere, however slowly, to be eliminated. So national costumes, met with by travelers in countries like Russia, Greece, Albania, Montenegro, as well as in Japan and some other eastern lands, are worn only by the conservative classes of the population and in districts remote from contact with the incoming foreign world. From being of the group, fashion in dress comes to be national, then finally international, until men the planet over tend to differ from each other only in feature, speech and mental traits. There is already, in fact, a world fashion to which all well-dressed men everywhere conform.

Not only in dress, but in all the equipments which go to make up what we call civilization do men imitate each other. From pencils to watches, from hats to agricultural implements and locomotives, our modern machines turn out like things in vast numbers, and they find their way to the ends of the earth. The invention of some utility or labor-saving appliance leads to a universal demand for it. Commerce helps to create as well as to supply needs common to the race. Nations buy each other's manufactured products, assimilate each other's industrial processes, imitate each other's business methods, and even adopt each other's forms of municipal administration and national government. Into the possession of new scientific discoveries all lands enter; to all of them spread the latest methods of combating disease. The literature of each people, by translation, becomes common property. Ideas travel from country to country, and minds once isolated grow more and more alike. And in each case the meaning of the assimilative process is the same. The more men resemble each other in fundamental characters, differentiated as they may be by function in superficial characters, the more easily will they work together. The completer the unification of the race — the larger the numbers unified — the greater will be the contribution made by all to each and by each to all. World assimilation, assuming the limitations of it needed for function, is thus a drift towards maximum efficiency: its goal is world coöperation.

CHAPTER XXVI

IMITATION AND "ORIGINALITY"

THE notion of spontaneity dies hard. It was at high tide when primitive man read his own abounding vitality into the environment. It has lost caste in these scientific days, and many of us still cling to the belief that we are living in a world of interdependent things, where changes take place not capriciously but according to rule, and where a settled causal order gives us the power of both retrospect and prevision. But the pack of knowledge has been again shuffled, and some are attempting to give us a new deal. So far as the cards have come out, they present unfamiliar signs and pictures that bewilder. We miss, for example, the "things which abide" on which so many of Nature's vicissitudes used to be founded; we confront self-originating actions which have no support in objects; indeed, the whole universe, as they tell us, is made up of just such actions minus things.[1] Substance reappears as an impulse to create, and it is through this *exigence de la création* that chaos passes into cosmos and matter arises. Then the torch of spontaneity is handed on to organisms, making it possible to explain as well as illuminate the mysterious realm of life by what is called *l'élan de vie*, or *le grand souffle de la vie*. In both inorganic and organic new events constantly start into being; there is an irresistible rush upward and onward of the actions which act; anything old may happen anyhow, something new may suddenly come up anywhen from anywhere. Nature, in a word, is "original." Her supposed link with the past is a scientific superstition soon to be outgrown, and her supposed amenableness to prediction must henceforth rank as crass intellectualism. She is free beyond the wildest dreams of caprice; her willful products pour forth unceasingly; and it is not her recurrences, her repetitions, her imitations, but her endless "novelties" to which our gaze is directed.

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[1] Henri Bergson, *L'évolution créatrice*. "*Il n'y a pas de choses, il n'y a que des actions*" (p. 270).

This belief in the spontaneity of Nature is of a piece with the idea of self-sufficiency in men. The notion of human originality has survived the exaggerated individualism of the nineteenth century into our own day. The cult of "self-reliance" is still a factor in so-called character-building. We continue to be warned, in various voices and from various quarters, against slavish subservience to inherited modes of action and conventional ways of thought. There is a widespread distrust of "ruts," and a more or less outspoken prejudice against "beaten tracks." The age rings with the praise of originality: It is not the plodding worker, but the man of new ideas who is most in evidence. In art, literature, science, politics, the palm is everywhere awarded to the original mind. There is optimism in this tendency, and its effect in stimulating effort is undoubted. The injunction "Be yourself — do not imitate!" has frequently brought out native powers that might else have slumbered. Even the *délire des grandeurs* must have had its influence upon progress. But how far can the cult of originality make good its claim? To what extent is the individual really self-sourced and spontaneous in his activities? When and where does he cease to be dependent?

Unless all signs are at fault, man himself is an imitation. Not only, by virtue of being an organism, is he separated *toto coelo* from all the forms of non-organic existence; in fundamental characters he at once inherits from and resembles all the living creatures that have preceded him.

The worm that crawls and the biped who looks up to the heavens carry on the same physiological processes, however these may differ in complexity and incidence; even the non-locomotive plant shares with the higher order of animal the activities which are needed for self-maintenance. The doings of human beings are similarly linked by the bond of likeness. If man is an expanded model of the lower organic life, he is also an imitation of the individuals who belong to his own society, even an imitator of himself. His most spontaneous actions show the recurrence, in however modified a form, of his activities in the past. Habit is heredity writ large; and the growing ease of a direction once taken, enlisting the whole power of the organism in its favor, insures those repetitions which Kierkergaard has called "the satisfying bread of daily existence." Meanwhile man is being constantly assimilated to his surroundings and his society. As molecules must resemble each other to form any particular substance, so human individuals must be fundamentally alike in ways of acting and thinking if they are to coöperate. The lower animals are born in an advanced state of fitness for life; men need to be "licked into shape." The process of qualifying them for human society begins with home education, through which speech and customs are passed on by the old to the new generation. The schools simply enlarge this process with a formal training directed, not to the encouragement of originality, but to the molding of the individual, in knowledge, conduct and ideals, into likeness with the race. The all-potent assimilating forces of everyday life then come into operation, and the individual who would fain be himself yields submission to his social environment in thousands of ways.

But there is surely scope for originality in the free life of the spirit, in the products of the mind. Admitted that language itself was a joint creation, the great ideas of the race must have flashed up suddenly in the brain of some supremely endowed individual. How suddenly? The existence and unity of Deity were proclaimed more than 3,000 years ago by the Hindu Vedas; at least as ancient is the pantheism which teaches the oneness of God and the world. The conception of an ether system from which all matter arises and to which it returns may be found, in however rude a form, in the *apeiron* of Anaximander. The modern scientific teleology which with Naegeli and Haeckel endows the atoms with elementary feeling, had its anticipation in the hylozoism of the Greeks. Newton's law of the equality of action and reaction was implied in the strife which Heraclitus read into the very constitution of things. The principle of the conservation of energy, "discovered" or experimentally demonstrated by Mayer, Helmholtz, Colding and Joule, may be found in Descartes, Kant, Huygens, and Leibnitz; the earliest suggestions of it date back to Aristotle, who spoke of the maintenance of the whole amid change of the parts, and to Telesius, who traced the unchanging "mass" of matter to a power of conservation. The atomic theory, underlying the fundamental creed of modern chemistry, was proclaimed by Leucippus and Democritus, who also clearly formulated the causal law which excludes chance from the natural order. The latest and "newest" theory in physics is the electron theory of matter, yet Lord Kelvin in his essay, "Aepinus Atomized," traced its main features to Franz Hoch, who wrote in 1759. Nor is the doctrine of evolution new in either its general or its special aspects. Not only did ancient thought contain the notion of the origin of life from the inanimate, it adumbrated, however imperfectly, the idea of the progression of life forms through natural selection. Democritus taught that living beings arose from slime, Anaxagoras that organisms came from the damp earth under the influence of warmth. Both Heraclitus and Empedocles announced the germ of Darwinism in their assertion that forms unsuited to the conditions perished, while forms suited to them were maintained.

Perhaps we find more originality in the sciences. Strictly delimited from each other by name and "special" to an extent not altogether good for them, they touch and interpenetrate each other at a thousand points. Proud in their isolated preoccupations, they are borrowers *à haute volée.* Each transmits by a sort of osmosis to the sciences most nearly related to it, and all benefit more or less from the contributions of each. The astronomer must be something of a mathematician and geometer, of a physicist and chemist; the physicist must know something of the inorganic sciences. What would the biologist do without chemistry, the paleontologist without geology, the sociologist without biology, anthropology and linguistics? Is it because science is modern that the sciences are interdependent? Mathematics and geometry come up to us from the dim beginnings of civilization, and despite up-to-date theories of hyperspace, Euclid is still a name to conjure with. We have spectroscopic analysis and heaven-piercing mirrors, yet astronomy was practiced in the ancient worlds of Chaldea, Babylonia, Assyria, and Egypt, and our star maps are still scattered over with Arabic and Latin names. The Chaldeans knew of the phases of Venus over 4000 years before Galileo saw them through his glass; the rotundity of the earth was reasoned out by the Greeks centuries before Magellan's ship circumnavigated the globe. We discuss the ether and its properties, call new compounds to the aid of our industries, watch the process of cell division through our microscopes, and gather endless materials for the sciences of mind and society; yet there have been physicists, chemists, biologists, psychologists, by whatever names they called themselves, since Nature-study began.

The sciences as "applied" ought to yield us the required evidence of spontaneity. Even here the bond with past achievement is unmistakable. Telescope, steam engine, telegraph — all the great "innovations" that impress us in the history of scientific progress — become intelligible only in the light of their historic background. The telescope no more came full-fledged from the brain of an inventor than did the spectacle-glass, and both had centuries of experiment in optics behind them. The magnifying lens focused the solar ray amid Assyrian darkness, and the sundial which tells the bright hours in our summer gardens pointed its shadowy finger to "the time" at least half a century before Christ. The steam-engine was anticipated in the aeolipile of Heron; navigation had the magnetic needle in second century Cathay; telegraph, telephone and dynamo were implicit in Gilbert and lay in the experiment of Oersted like the statue in the block of marble. The thonged pebble preceded the Nasmyth hammer, as the clepsydra with toothed wheel preceded the clock, and as the rude brick printing of Babylonia preceded the movable types of Forster and Gutenberg. We may call the digging stick of the Australian savage the ancestor of the steam plow; the stone sickle, the roasting tray, and later the tribulum, as Mason reminds us, were the progenitors of the steam harvester. The mechanically driven street carriage gave a good account of itself in pagan times, and one of the labors of Rameses II — to say nothing of Xerxes — anticipated by more than 3,000 years the modern canal-piercing operations at Suez and Panama. The Greeks had sails when the Pleiades were named; the seas are still white with canvas.

Will not the wonder-world of machinery give us some glimpse of the innovator depending wholly upon himself? Modern machines are vastly more complex than those known to the ancients, yet they are all products of cooperative effort resting on past achievement, and there is some justification for the claim that they embody a series of improvements rather than a succession of absolutely new creations. " Examine at random," says W. H. Smyth, " any one of half a dozen lines of mechanical invention. One characteristic common to them all will instantly arrest attention. They present nothing more than a mere outgrowth of the manual processes and machines of earlier times. Some operation, once performed by hand tools, is expedited by a device which enables the foot as well as the hand to be employed. Then power is applied; the hand or foot operation, or both, are made automatic, and possibly, as a still further improvement, several of these automatic devices are combined into one. All the while the fundamental basis is the old, original hand process; hence — except in the extremely improbable event that this was the best method — all the successive improvements are simply in the direction, not of real novelty, but of mere modification and multiplication."

Not only must the new machine, however " original," be founded on experience of all past machines; its " innovation " must take the course traced out for it, on the one hand by the properties of matter and the nature of energy, on the other by the underlying structural unity of all life. It is this unity, and not anything like voluntary choice, which makes man an unconscious imitator of mechanical contrivances first developed by organisms much lower in the scale of existence than himself. Hydrostatic principles are followed in the flow of blood through the arteries and veins; mechanical principles find illustration in the interplay of muscles, sinews and bones; the lever is a large factor in the movements of animals, and there is a ball-bearing at every point. The awl and the saw were brought to perfection by the boring insect, the beginnings of navigation are to be found in the floating pupa skin of the gnat and the sail of the nautilus. Uncounted ages before the African laid his earth traps, the Dark Continent was honeycombed with the pitfalls of the ant-lion. The climbing hooks of the tiger-beetle antedated grappling irons, as the scale armor of the armadillo preceded the soldier's cuirass. Poison was used by plant and animal long before the savage tipped his arrows with it; the gymnotus and his congeners invented the electric battery. The lowly firefly still outdoes man's highest powers of contrivance with a method of producing light without heat.

If the appeal be made to the fine arts, what does architecture say? Here there is indeed variation from age to age, yet through all mutations due to fashion or taste the laws of stability and proportion persist. Our decorative public buildings continue to remind us of Greece and Rome or of the Middle Ages. What is our "high-style" architecture other than Doric, Ionic, Corinthian, Romanesque, Gothic, Italian, or of endless minglings and modifications of these? No wonder that Fergusson distinguished between "the true and the copying or imitative styles" when he wrote: "It is not perhaps too much to say that no perfectly truthful architectural building has been erected in Europe since the Reformation. . . . In modern designs there is always an effort to reproduce the style of some foreign country or that of some bygone age — frequently both." Nor is the critic of to-day any the less emphatic. "Since the close of the eighteenth century," says Arthur L. Frothingham, "there has been no true style anywhere, but simply a series of fashions chasing each other across the background of equally mutable social conditions." "It has been a trouble to many," writes Russell Sturgis, "that in our recent American architecture a whole building, or a large and showy member of a building, should have been so closely copied from some fine old structure in Europe that it is easy of recognition. But those who are greatly exercised about this should not need to be told that such close copying has long been the rule in details. For what purpose are used those large photographs of small details of which every architect has as many as he can afford? . . . One need hardly fear contradiction in saying that in the majority of cases they are simply used for copying."

Sculpture and painting, essentially imitative arts, have models common to all. If it be said that the originality in this field consists in an unexcelled closeness of imitation, we may fairly ask to have the superiority indicated to us. The modern artist has undoubtedly outdone his predecessor in giving us "real" views of natural objects. But how modern is the realism? Man of the flint-chipping age carved figures on bone with a fidelity to life which anthropologists never tire of admiring. "Nearly every great group of animals," says A. C. Haddon, "is represented in native art, and often so faithfully that it is possible for the naturalist to give the animals their scientific names." Is it, then, in the ideal, the subjective element that we are to find spontaneity? Why have we not surpassed Phidias, Michelangelo and Canova in sculpture, Raphael and Leonardo da Vinci in painting? Nor is decorative art in any better case. A vast number of our modern patterns in ornamentation are to be found in the art of primitive peoples. The inventors of "new designs" in our art schools and elsewhere make a liberal use of the same natural objects which have served their clan in all the ages.

In music the notion of merely imitative effects seems overwhelmed by the thought of enormous resources of combination. Yet the recombining depends for its newness, so called, only upon the total structure of the composition, since all compositions consist of series of notes which have been repeated and re-repeated since drums were first sounded and stringed instruments came into existence. Within the general repetitions, moreover, there are special resemblances which connect the great compositions with the link, not only of heredity, but also of family likeness. The historians of the art are not content merely to ask what Richard Strauss, Brahms, Wagner, Mendelssohn, Chopin, Schumann, even Beethoven would be without Bach. They rearrange the imitations and redistribute the indebtedness. Mozart and Philipp Emanuel Bach are brought in to explain Haydn. Chopin's harmonic system is re-discovered in Wagner. Handel, as well as Bach, reappear in "Elijah," the "Saint Paul," and the "Reformation Symphony" of Felix Mendelssohn-Bartholdy. If Beethoven "seems to have included in his mighty symphonies all that had been," the same critic assures us that "in his ninth symphony and last piano sonatas may be found the seeds that sprouted into the luxuriant forests of the Wagner music, and gave birth to the dream-haunted imaginings of Chopin, Schumann and Berlioz." Everywhere we hear the "dominant note" gathering the past to its timber, but only to sound down again through the ages. "Originality" and indebtedness in music refuse to be disassociated. Note the dedication of a recent book on "Grieg and His Music" to "Edward MacDowell, America's most original composer, who was more influenced by Edvard Grieg than by any other master!"

CHAPTER XXVII

IMITATION AND "ORIGINALITY" (Continued)

THE chosen home of spontaneity, then, must be literature, since here we recognize the actual workings of the individual mind. The fundamental likenesses of Nature and man predestined the family resemblances of *belles lettres* the world over from the beginnings. The Mahabharata tells us all that we need to know of their antiquity. The ancients — India, Greece, Persia, Arabia — have given us not only inspiration, but also style and material. Philostratus, the Athenian, supplied B.C. 170 the original for Ben Jonson's "Song of Celia"; the Book of Job and the old Hindu theater gave Goethe the idea for the "Faust" prologue. That the Iliad and the Odyssey are the chief sources of all later story writing has become a literary commonplace. It was this universal indebtedness to Homer which led Voltaire to write, "If this father of poetry could recover from his descendants all they have borrowed from him, what would remain of the Æneid, of the Jerusalem Delivered, of Roland, of the Lusiads, of the Henriade, and of all the things of this kind one dare name?" Virgil imitated Theocritus, says M. Benoist, "not only in the choice of subjects, but also in the details of his style and of his personification; he borrows verses sometimes entirely, being content only to translate." And Eichoff adds the accusation that the great Latin poet copied from his compatriots Ennius, Attius, Catullus, and Nevius.

The moderns begin, but do not end, with the imitation of antiquity. "Chénier," says B. de Fougière, "has not a scene which he has not borrowed from the ancients," and it is the opinion of Alfred de Musset that "Greek tragedy, that majestic and sublime ocean, gave birth to both Racine and Alfieri." The "Wasps" of Aristophanes reappear in Racine's "Les Plaideurs," as the fables of Æsop and Phedrus reappear in Gellert, La Fontaine, Kryloff, and Afanassieff. Boccaccio gave rise to a host of imitations, among them the "Canterbury Tales" of Chaucer, and sixteenth century English poets did not disdain to polish their compositions under the light shed by Dante, Ariosto and Petrarch. Spanish romances were the foundation of Spenser's "Faerie Queene," and Spenser himself had an imitator in Phineas Fletcher. Milton looked for sources and suggestions to Homer, Virgil, Tasso, the plays of Pindar, and the Old and New Testament. Renz de Gourman calls Fénelon's "Télémaque," itself a borrowed style, "the most imitated work, phrase for phrase, in all literature." As Shakespeare's "Comedy of Errors" had its source in Plautus, so Corneille's "Cid" has been traced to a Spanish drama by Guillen de Castro. "Dryden's second best play," says Saintsbury, "is built with an audacity to which only great genius or great folly could lead, on the lines of Shakespeare. His longest and most ambitious poem follows with surprising faithfulness the lines of Chaucer. His most effective piece of tragic description is a versified paraphrase — the most magnificent paraphrase perhaps ever written — of the prose of Boccaccio." "The imitation of Pope," according to Edmund Gosse, "grew to be a rage from Sweden to Italy," yet the brilliant Pope was himself an imitator. His "January and May" is a modernized version of Chaucer's "Merchant's Tale"; his "Dunciad" was modelled upon the "MacFlecknoe" of Dryden. If Pope sat at the feet of Horace, Sterne borrowed from Rabelais, Montaigne, and half a dozen others. Defoe studied Bunyan assiduously, "hence the excellence of Robinson Crusoe." In the writings of Charles Lamb look for Sir Thomas Browne, Fuller, Earle and Overbury, Burton and Isaak Walton. And so the story goes on.

How far a great writer who compels others to copy him may himself be a borrower is conspicuously seen in the case of Goethe. "The air which Goethe breathed," says Hermann Grimm, "was filled with Rousseau's spirit; and we have only to compare Werther and Lotte with St. Preux and Julie to be convinced that without the latter the former would never have been created. The heroes of the 'Nouvelle Héloïse' and of Goethe's romance, if their silhouettes could be placed side by side, would be found to coincide line for line. If St. Preux and Werther had met in life they would have regarded each other with the terror with which one meets his double. . . . What Goethe added from his own character and Jerusalem's personality appears only like the accident of custom and situation. . . . It seemed to Goethe as if a special providence had thrown Rousseau's romance into his hands, and he felt compelled to adhere to his model. But not alone for the conception of the characters in 'Werther' is Goethe indebted to Rousseau. He is in fact in quite as great a measure dependent upon him for the color."

The fervid and far-famed Chateaubriand took Bernardin de St. Pierre for his model, yet "you will not find a single page in all our writers," says Sainte-Beuve, "which has not had its germ in Chateaubriand"; and it is to Chateaubriand that Lanson traces Victor Hugo, "alike in his picturesque descriptions, his epic visions, and the use he makes of historic erudition." Jeffrey called Lord Byron "a mere mimic of styles and manners, and a great borrower of external character," adding, "He and Scott, accordingly, are full of imitations of all the writers from whom they ever derived gratification, and the two most original writers of the age who would thus appear to superficial observers to be the most deeply indebted to their predecessors." Yet the wave of Byronic influence not only overwhelmed Pushkin and Lermontoff in Russia, Mickiewicz, Gagarinski and Krasinski in Poland — it moved Victor Hugo, Alfred de Musset and Dudevant in France, and reached Heine in Germany. It was Mickiewicz who once said that Byron was the secret link which bound the whole literature of the Slavs to the West. And if we were to pursue still further this interesting study, we should read of Coleridge lighting his fire from the candle of William Lisle Bowles, of De Quincey "preferring the ornate manner of Jeremy Taylor, Sir Thomas Browne, and their contemporaries," of Shelley embodying in his "Alastor" and the lyrics echoes from Wordsworth and Moore, and of "suggestions which it is difficult to believe that Thackeray did not in the first instance owe to Dickens." "Who," asks A. W. Ward, "would venture to call Capt. Costigan a plagiarism from Mr. Snevellici, or to affect that Wenham and Wagg were copied from Pyke and Pluck, or that Major Pendennis was founded upon Major Bagstock, or the Old Campaigner in the Newcomes on the Old Soldier in Copperfield? But that suggestions were in these, and perhaps a few other instances, derived from Dickens by Thackeray it would, I think, be idle to deny."

In numerous cases there is affirmation, rather than denial, by the authors themselves. "I copied my personages," says Racine, "from the greatest painter of antiquity — I mean Tacitus; and I was then so full of my reading of this excellent historian that there is scarcely a brilliant touch in my tragedies of which he did not give me the idea." Dr. Johnson told Boswell that his style was founded on Sir William Temple. Southey, writing of his own work, says, "I see in 'The Doctor' a little of Rabelais, but not much; more of 'Tristram Shandy,' somewhat of Burton, perhaps more of Montaigne." "I am neither actor nor poet," Lessing tells us, "but I should be so poor, so short-sighted, if I had not learned in some degree to borrow others' wealth, to warm myself at others' fire, and to strengthen my eyes with the lenses of art." Goethe said to Eckermann one day, "We bring capacities with us, but we owe our development to a thousand influences from the great world out of which we appropriate what we can and what is suited to us. I owe much to the Greeks and the French; my debt to Shakespeare, Sterne and Goldsmith is infinite." John Stuart Mill admits that he rendered his style "at times lively and almost light" by the study of writers "who combined, in a remarkable degree, ease with force," among them Goldsmith and Fielding, Pascal and Voltaire. "Whenever I read a book or a composition that particularly pleased me," says Robert Louis Stevenson, "I must sit down at once and set myself to imitating that quality of propriety or conspicuous force, or happy distinction in style. I was unsuccessful at the commencement of it, but I got some practice in these vain bouts in rhythm, in harmony, in construction, and in coördination of parts. I have thus played the sedulous ape to Hazlitt, Lamb, to Wordsworth, to Browne and Defoe, to Hawthorne, to Baudelaire and to Obermann."

From such salient examples and opinions — the examples offered to suggest an unexhausted wealth of illustrative material, the opinions cited from experts writing with no special view of imitation in mind — it should be evident that spontaneity of product forms but a limited factor in individual achievement. In presence of them the whole edifice of so-called originality crumbles before our eyes as we examine it, but it crumbles only to be built up again on a more reasonable and enduring basis. A foundation of imitation, of repetition, of submission to habit and subjection to convention is required at the outset. The mass of social units must repeat their community with a close approximation to faithfulness. It is out of the general level thus secured that progressive variations take their rise, and it is among these variations that the claim for at least a relative spontaneity of individual achievement finds its greatest strength. Yet even here, in the common acceptance of the term, originality is not a true, but a pseudo-idea. The law of consciousness itself misleads us into diminishing race contributions and magnifying individual contributions. Not only do differences — variations from the customary — impress the average mind much more profoundly than likenesses, but phenomena in the present are vastly more easy to realize and appreciate than the long elapsed phenomena of the past. It was because the reflective grasp of the intellect matures only slowly that insight into evolutionary processes came late in the history of the race. The hypothesis of the origin of natural products by abrupt and sudden creative acts was a realizable — the only realizable — view of Nature in an earlier stage of intellectual development; with the growth of mental power it became crude and unsatisfactory. When men progressed to the idea of metamorphosis by physical change the mind rested for a while in the notion of catastrophic vicissitudes, periodical upheavals that changed the face of the world. It took ages to reach the thought of evolution as the result of very slight changes accumulated through long intervals of time. So in our estimation of human products, it is vastly easier to regard them as arising suddenly and spontaneously as the creation of particular individuals, than to recognize them as the outcome of contributions made by all individuals.

Nor is it only that appreciation of the dependence of the present on the past grows with the progress of the race; the dependence itself is an increasing quantity. It was Comte who said that the longer our species lasts and the more civilized it becomes, the more does the influence of past generations over the present, and of mankind *en masse* over every individual in it, predominate over other forces. With the advancing unification of the race the scope for really "original" achievements by individuals is a diminishing, not an increasing quantity. And this is true in the realm of action, as well as in that of thought. The isolations of the tribe, making the subjection of its members all the more easy, gave opportunities for the development of the "strong man" which are not yielded by modern society. The captain of industry, the prominent statesman, the successful general, conspicuous as their doings may be, achieve results under an increasing control, and must more than ever acknowledge the final domination of the masses whom they are supposed to wield. In the isolation of peoples and races the world had its Ghingis Khans, its Tamerlanes, its Alexanders, its Fredericks; the new international configurations make another Napoleon or another Kaiser an impossibility. The old order in science brought forth individual inquirers who knew little or nothing of what others were doing, whereas to-day scientific discoveries, universally diffused, become the common property of all, and the investigators of Nature are joined together, not merely by the printing press, but by national and international scientific organizations. The separate compartment method of study so favorable to individual variations in science has also passed for literature. In earlier times, when education was costly and rare, individual writers stood out like giants above the mass of their contemporaries. For the one thus conspicuous we now have hundreds in every large community who can write well and with some degree of literary power. And if we turn to the nations which have given us our greatest books in the past, we find them nurturing, not figures isolated by surpassing gifts, but swarms of able *littérateurs* who compel our attention without always dazzling us with their genius. The danger of our distributed culture is not that it may produce too many great names, but that such few as give promise of appearing will find themselves swamped in the dead level of literary mediocrity.

Meanwhile the larger angles of human life are being worn down. If the nation is an imitation of previous stages of national existence, repeating, with whatever variations and modifications, the ideas, customs, institutions of those stages, so is the nation more and more an imitation of other nations. In the earlier days of the race, seas, mountains, rivers, were effective barriers to intercourse, and the separated peoples grew up in an individualism of life and thought, of costume as well as custom, which still lingers here and there in Europe and the Orient. But the science which binds continents together with railways, which pierces mountains and navigates the most distant oceans, bids fair to diminish national "originality" almost to the point of disappearance. Nor is the movement less in evidence where the changes wrought take the direction of progress. Cities catch from each other the methods that make for social and political advance; industrial improvements pass from country to country; new ideas of government, especially of democracy in government, are rapidly becoming the common property and heritage of all the peoples. Yet through it all, whether we call it "standardizing," holding-down, or leveling-up, the process is one which insists on the assimilation of each group to the general life of all the groups. The nation may plume itself on its "originality" — may determine to be itself. It must yield, and is constantly yielding, to the influences that reach it from without. For it is not in the superficial differences that linger, nor yet in the progressive variations sure to arise, but in the fundamental likenesses which coöperation at once requires and helps to produce, that the hope of a world democracy is bound up.

Originality is of the race, and not in any valid sense of the individual. The progressive variation subsumes and requires the whole hierarchy of such variations in the past. The ascending step of the innovator is indeed indispensable to advance, but it can be taken only with the whole stairway of previous human progress for its substructure. As the most striking individual traits of the human countenance would be lost in a composite photograph which included all living men, so the individual achievement dwindles into comparative insignificance when viewed against the background of all human achievements. The story of man's dependence upon his kind is really the story of nature writ large. The vibrating electron, the revolving planet, the rushing star, the gathering nebula — these would be powerless and motionless without the universe. The topmost peak that pierces so proudly into the sky requires the vast bulk of supporting mountain for its elevation; the wave-front which wastes a cliff or destroys a breakwater has the whole length of thundering ocean behind it. The wonderful adaptations of the individual plant would be impossible without the long travail of the species to which it belongs. Is it less reasonable to say that the most brilliant achievement of the human individual receives its impulse and derives its possibility from the total life out of which it also emerges?

Nor does the power of initiative, of self-reliance, lose anything by being regarded not as self-sourced, but as system-sourced. It rather gains immensely from recognition of the mighty reservoir which may be depended upon and drawn from for individual human effort. In the new conception of originality which science has done so much to develop, each man will more than ever look for his salvation to the larger self which is outside; and it is within this wider framework of opportunity that the determination to be "original" will find increased scope for exercise. The individual contribution is to grow rather than diminish, but it will grow just because the streams that feed it flow in from the present and up from the past in ever augmented volume. The progressive variation is to have a value unheard of before, yet its blessing will be multiplied, not by any solitary virtue of the individual, but by the accumulated richness of human powers and the advancing unification of mankind. The innovator most likely to be "original" in the future is not he who, in mistaken independence, lays claim to a lawless spontaneity of production unrelated to the total yield of human effort but the man who, most completely realizing and utilizing that yield, goes forth armed with the whole power of the race.

CHAPTER XXVIII

IMITATION IN PLAY AND ART

From the earliest beginnings of civilization man's energies have bubbled over into that constructive imitation of external objects which we call creative art. As member of society he gains agreeable and avoids disagreeable feelings by becoming likes to others; as spectator of the human and inorganic panorama he finds pleasure in the recognition of likeness, wherever it may manifest itself. A higher satisfaction comes to him when as artist he engages in the production of likeness. For likeness in artistic activities, as in natural processes, is the direction of least stress: it involves a minimum expenditure of power; it is for conscious human effort at once most easy to produce and most agreeable to contemplate. If for whatever reason man must mimic the world around him — must put his observations, memories or ideals into objective forms — then he is obeying the law of all motion in constructively imitating things, personages, events and activities.

The simplest forms of artistic imitation, requiring neither tools nor material, are those of mimetic gesture. "The African negritos," says Keane ("Man Past and Present," p. 55), "have a decided talent for drollery, and are skilful mimics. . . . They never fail to imitate in a striking manner the hopping of the kangaroo and the solemn movements of the emu, and never fail to make the spectators laugh." The natives of Australia can accurately reproduce a man's gait so that the person represented is immediately recognized. In the "Zeitschrift für Erdkunde," Vol. 4, Joseph Hahn mentions a Herero performer who with his stringed instrument could imitate the march of the most different animals. Schweinfurth tells of a Bongo who could reproduce many of the sounds of the hurricane. Captain King, in his "Voyage to the Pacific," describes the bear dance of the Kamchadales as "an exact counterpart of every attitude and gesture peculiar to this animal." The Fijians, in their sea dance, are able to suggest how the ocean, when approaching a cliff, gradually ascends to its summit. In the tree dance at Utkiavwin ("The Point Barrow Eskimo," by John Murdock, 1892) each dancer in turn sprang to the front, and in extravagant gestures went through the motions of killing seals, walrus and deer, and the pursuit of the whale. The dance mimic is sometimes accompanied by song, as in the cases witnessed by A. W. Howitt ("The Native Tribes of South-East Australia"):

> I have mentioned songs which are accompanied by rhythmical gestures, or by pantomime, which greatly adds to the effect. A favorite one which I have seen describes the hunting of an opossum and its extraction from a hollow log by the hunter, who is the principal singer, and his assistants. Every action of finding the animal — the ineffectual attempt to poke it out of its retreat, the smoking of it out with fire, and the killing of it by the hunters as it runs out — is rendered not only by the words of the song, but also by the concerted actions and movements of the performers in their pantomime dancing. . . . A very favorite song of this description has traveled in late years from the Muring to the Kurnai. It was composed by Mragula, who was a song-maker in his tribe, the Wolgal, describing his attempt to cross the Snowy River in a leaky canoe during flood. The pantomimic action which accompanies this song is much fuller than the words, and is a graphic picture of the pushing off in the canoe, the paddling into the stream, the gaining of the leak and, after an ineffectual attempt to bale the water out by hand, a hurried return to shore. Then the hole, being carefully stopped with adhesive mud, the performers again put off and paddle across. (P. 423.)

There is also the special mimicry of play. Even among animals efficiency is thus developed: we read of "the throwing up of heels, pretended panics and mock battles" among them. In animals "with greater celerity and certitude in their motions the feeling manifests itself in more regular and often more complex movements. Thus felidae when young and very agile, sprightly species like the puma, throughout life simulate all the actions of an animal hunting its prey." ("The Naturalist on the La Plata," p. 280.) As kittens play with a ball, treating it as if it were a mouse, so dogs chase or "worry" objects thrown before them. In the plays of children mimicry is both individual and collective. Girls imitate the activities of their mothers in nursing, keeping house, running errands; boys mimic the activities of men in playing at store, hunting, and soldiering. The younger enjoy such games as "kiss-in-the-ring," "hide-and-seek," "follow-my-leader"; the elders find amusement in the "mock trial," or the "poverty party." And all these plays draw their interest from the fact that they are imitations of life.

As man ascends in intelligence, as the social system grows more complex, the ruder resemblances seen in individual mimicry and the collective dance pass by expansion into theatrical representation. Originating in a simple choral performance into which dialogue is introduced, the stage play gains by elaboration; beginning with two or three performers occasionally employed, it comes finally to be the regular occupation in each theater of a large number of actors and actresses continuously engaged in a profession which they have adopted for life. At first the mimicry is suggested by little more than speech, the listener being expected to actualize for himself the places, personages and events described in the dialogue; in the end the play has been elaborated into a highly complex cast whose several parts, each undertaken by a particular individual, are acted out before the audience with appropriate movements, gestures and words. The mimicry of dress in its simplest form was seen in the Roman theater, where an actor wearing a long robe and holding a scepter aloft did duty for a king; upon this there has been superposed a whole science of costume, while to the imitation of man there has been added a hardly less varied mimicry of Nature. And the speech of the performers, from being the crude work of one of their number, comes finally to be the choicest product of literary invention. By preference, the great passions of mankind are depicted on the stage: "in the presence of tragedy," as Nietzsche says, "all that is martial in us holds saturnalia." ("Goetzendämmerung," p. 136.) Yet whether the heroic or the comedy element is most in evidence, and whatever be the subject of the representation, the dramatist and the actor succeed best when they most faithfully mimic life.

The use of objects for purposes of mimicry begins for all races in childhood. In civilized countries most young people are fond of cardboard imitations of houses, churches, villages, farms and other familiar features of the environment. A set of mock furniture, an imitation piano, a miniature table or stove, give endless pleasure to children who take little interest in the real objects. So the contents of any toy shop, with its mimic animals, soldiers, cannon, steam engines, electric railroads, are eagerly made use of in play. Nor does this form of imitation always require actual likeness of form: the representative objects may be little more than symbols. Grosse, in one of his books on play, mentions the girl who makes a favorite baby of a knotted handkerchief or some other formless object, and the boy who calls the stick a horse, a pile of sand a mountain, a collection of chairs a railway train. "The most useful doll I ever saw," is the avowal of Tylor ("The Early History of Mankind," p. 108), "was a large cucumber in the hands of a little Amazonian Indian girl; she nursed it and washed it and rocked it to sleep in the hammock, and talked to it all day long." "An imaginative child," says the same writer, "will make a dog do duty for a horse, or a soldier for a shepherd, till at last the objective resemblance almost disappears, and a bit of wood may be dragged about resembling a ship on the sea or a coach on the road. Mr. Backhouse one day noticed in Van Dieman's Land a woman arranging several stones that were flat, oval, about two inches wide, and marked in various directions with black and red lines. These, he learned, were absent friends, and one longer than the rest stood for a fat native woman on Flinder's Island known by the name of Mother Brown." From such primitive symbolism as this the transition is easy to the stones with which the Israelites represented the twelve tribes, the famous "Rolbrich" in Yorkshire, the "Hurlers" of Cornwall, "Long Meg and her Daughters" in Cumberland, then to the likening which has come as an afterthought, as in the strewn blocks which in many countries take on the shape and tradition of petrified giants, in the imposed symbolism of avenues of monoliths at Karnak, in the stone circles which the English associate with Puritanism and the punishment of witchcraft, in the "profiles" of distinguished men which rocks are sometimes held to body forth, in the "footprints" of Buddha and other deities in the East. And out of this deep-seated impulse to mimicry come the studied imitations of creative art by a process which, beginning with the rude stone figures of the savage, reaches its culmination in sculpture and painting. Man mimics the human form; he also imitates Nature: hence grounds turned into artificial forests, grottoes, miniature lakes, ponds filled with choice fish. His temples and dwellings, in decorative elements, at least, have always displayed this mimicry in degree; and though it is a far cry from primitive zoömorphs and anthropomorphs to modern leaf and flower patterns, the process is throughout the same.

Note also how, by a sort of inflection, things useful for human maintenance are made to take on the shapes of natural objects. The pipes which the American aborigines molded into the forms of snakes, frogs, beavers, cats, turtles and birds have plenty of modern analogues in rugs, bracelets, breast-pins or cuff buttons made wholly or partially in the shape of some plant, insect or animal. Bone, card, and "piece" games usually have some imitative reference to real life. Chess is manifestly a game of state as well as a kriegspiel; as in draughts, advance and retreat, attack and defense, capture and surrender, form its alternating aspects. Cards show a mimicry of royal and other official personages — a feature also common to dominoes. In the game of the Micmac Indians known as "woltestomkwon, the king-pin is called "the old man," the notched stick represents his three wives, and the plain sticks mean his children. The Burmese "Chit-Tareen" game has a king, a general, lieutenant-general, war chariots, elephants, cavalry and foot soldiers. The players of the ancient Indian "Chaturanga," a form of dice chess, use a rajah, an elephant, a horse and a ship. The "Tseung-ti" game of Canton, China, names its pieces generals, councilors, elephants, horses, chariots and cannon. A lion, a serpent, a youth, a queen and dancing girls figure in Persian playing cards. The Siamese have fish in their game, the Hindus tigers, and lambs, the Egyptians lions and hares, the Ammara Indians a spread-eagle, the Chippewa Indians a fish, a hand, a door, a man, a canoe and a half moon. The earliest German cards show dogs, falcons, stags and ducks; Swedish cards of the last century represent a fool, harlequin, flower-pot, wreath, inn, boar, knight, hussar and cuckoo; the *hexencarten* of Germany picture a witch, cat, horse, sentry and parrot. ("Chess and Playing Cards," by Stewart Culin, Report of U. S. National Museum for 1896.)

There is mimicry of man and Nature even in that indefinite body of systematized sounds which we call music. It ranges in instrumental music from the imitation of rippling brooks or waterfalls to moonlight — from the mimicry of the thunderstorm in Rossini's "Overture to Wilhelm Tell" to that of bell ringing, the tramp of soldiers, and the din of knives and forks. An "Anvil Chorus" is heard in "Il Trovatore," and a "Hailstone Chorus" in "Israel in Egypt." In Wagner's "Walküre," says Hans von Wolzogen, "the wind blows, thunder rolls, the lightning flashes in the rising and falling sway of the orchestra"; the stroke of the weather god's hammer resounds in the "Motive of the Storm." Goddard heard "the waves following one another rhythmically and continuously" in Handel's chorus, "But the waters overwhelmed their enemies" ("Israel in Egypt"). "How admirably," writes Gardiner of Beethoven's Pastoral Symphony ("The Music of Nature," p. 242), "do the violins in that extraordinary composition represent the soft, fluttering stir of insects — the hum in the noonday warmth of a summer day!" In Haydn's Thirty-eighth Quartet there is the mimicry of a dog's bark, and in his Seventy-sixth Quartet that of a braying ass. The song of a nightingale is also heard in Haydn; Mozart, Rossini and Beethoven have each mimicked the cluck of a hen. The tread of a giant's feet is heard in the "Rhinegold." Mozart's Fifth Quartet has sounds which suggest children at play; Beethoven's Symphony in C Minor mimics children frightening each other. Three persons in a passion are imitated by Beethoven; his Third Trio gives the sob of a child; in Haydn's Fifty-eighth Quartet a mother fondles her infant. There are musical imitations of laughter by Handel. Haydn's Fifty-seventh Quartet mimics sneezing; a cough is heard in the Eighth Symphony. So naïve sometimes is the method that Wagner could indicate upward flight by an ascending scale, while Purcell was able to suggest the fall of Troy by the equally simple expedient of a descending scale; so complex may the mimicry become that Gurney ("The Power of Sound," p. 307) speaks of the emotions induced by music as rising "to extraordinary power, as when some mighty polyphony, in its resistless plan of tumult and order, calls up deep, indefinable associations of the mightier streams of lives and fates." Most suggestive of all are the cases in which, without intentional direction on the part of either composer or performer, the mind weaves the musical sounds into patterns imposed by its own experiences, desires and states. "Different ages," says Schumann, "select different combinations for their texts and pictures: where a youth of eighteen hears a world-famous occurrence in a musical work, a man perceives only some rustic event."

CHAPTER XXIX

ASSIMILATION IN LANGUAGE AND THOUGHT

THE whole realm of our means of intercourse with each other is rich in the mimicry of sounds, objects and activities. Earlier than the art of writing, with its picture letters and words — its phonetic imitations as well as its resemblances of form, their remnants still discoverable in our Roman script — was the speech of sign and gesture whereby the individual man communicated to others his wishes and his thoughts. Yet there was the same likeness of sign to thing signified in the waved line which the Egyptian used for "water," or the inverted cover with the star beneath it which was his symbol for "night"; in the horn of the upturned fingers with which the Indian indicates "deer," or in the planting movement by which he announces that somebody is "dead"; in the abbreviated mimicry of the native Australian for whom "breast" means "woman" and "beard" signifies "man." From the ancient hieroglyph to the modern rebus this process has never really been suspended; and though, after centuries of the wear and tear of language, the onomatopoetic, the imitative elements of speech are not now so much in evidence as they once were, language still keeps the memory of the pictographs of sight and sound which it long ago engulfed.

Full also of mimicry is the domain of words and ideas. We speak of the hands of a clock, the ears of a book, the nose of a promontory, the legs of a table, the veins of a marble slab, the teeth of a saw, the mouth of a cannon, the eye of a needle, the neck of an estuary, the joints of a pipe, the jaws of a wrench, the sinews of war, the lungs of a bellows, the bones of an umbrella. Resorting to analogies based on the activities of the human body, we describe inanimate things as standing, sitting or lying, as rising or falling: the light "dances," the lake "sleeps," the precipice "yawns"; there are "laughing skies," "angry clouds," "smiling landscapes," "babbling brooks," "raging billows." Some meanings are reinforced from the senses, as in the case of *Taube Nuss* (with nothing in the shell) and *Taube Kohlen* (*Kohlen* which have burned out); note also the French application of the word *sourd* in description of noises. To the German *Sackgasse,* comparing a street without outlet to a "sack," we give the name of "blind alley." "Blind windows" were once common in the days of the window tax; and "blind walls" are almost unknown save as lingual survivals. The "blind ditch" — the *caecum vallum* of the Romans — is also from ancient history, though not so antiquated as the Hindu *andhakupa,* "blind well," a deep, well-like hole of which the mouth was concealed. In Italian *cieco legno,* "blind wood," is used of any growth of trees hidden from view. The Spanish have a kind of cheese which they call *ciego,* or "blind," literally "without eyes." The term "stone blind" is found in many languages. Night was "blind" to the Latins, blinded by the darkness, as in the expression *caeca nox.* In German a *blinder Schuss* is a shot that has failed. In our own noun "window blind" we treat the window as an eye, and we deny vision in such expressions as "blind anger," "blind prejudice" and the like, and there is a further, more concrete resort to human characters when we speak of lame arguments, halting statements, unpalatable truths, tasteless compositions, insipid criticism, pregnant sentences, heartless rejoinders. The adjective "quick," with the meaning of "alive," appears in such terms as "quick-match," "quicksilver" and "quicksand." The French say *La chandelle se meurt,* in analogy with our own "dying flame." In Welsh there is the expression *marw lanw* for "dead water," signifying the moment of rest which comes between high and low tide; the French also speak of *eau vive* and *eau morte.* When there is no wind stirring the Dutch say *Det is dood stil* — "It is dead still," the equivalent of our own "dead calm" or "dead silence." On the one hand we use such phrases as "dead weight," "dead level," "dead lift," "dead pull"; on the other Americanisms like "live man," "live undertaking," "live newspaper." In France an *atelier* is *vive* when it is full of workmen; in Germany *Kapital* is *todt* when it bears no interest.

All languages show this mimicry; in all of them there is resort to the sense organs, or to words descriptive of sense impressions, for the speech forms which are to enable the mind to deal with qualities, states, changes or relations that can neither be seen, heard, tasted nor smelled. The most familiar illustration belongs perhaps to the formal rhetoric of oratory; and here the appeal is often made to the feelings. Thus we read of burning thoughts, weighty utterances, withering criticisms, staggering assertions, rousing addresses, feeling observations, glowing enthusiasms, painful allusions. Personal manners are said to be cold or warm: we hear of blunt speech, keen expressions, sore disappointments; of icy sneers and sharp retorts; of dark destinies, fair prospects, shining goals. The sense of vision is emphasized in a number of colloquial forms: thus "black" is the familiar characterization of acts of villainy, while "white" is as frequently applied to conduct suggesting purity and blamelessness. "Blue" we find associated with conditions of discomfort and dissatisfaction; "green" appears in street *argot* as a convertible term for envy, also for inexperience; "red," in phrases like "red-handed" suggests the sanguinary aspects of evil-doing;

other speech forms depending for their concrete effect on color include "the blues," the "brown study," the "pink of perfection," and "yellow journalism." To these examples of a large class may be added such anthropopathic phrases as those in which men support enterprises, jump to conclusions, grasp arguments, shake off troublesome thoughts, talk shop, ride roughshod over, give an inch and take an ell, send the hat round, put on sackcloth and ashes, *aller planter ses choux, aver il cuore in bocca, ueber alle Berge sein.* Then there are hundreds of abstract terms in common use, all of them traceable to some highly concrete object or process that originally acted on the mind through the sense organs; thus "character," from the process of grooving or engraving; "tribulation," from the operation of separating corn from the husk; "ambitious," from *ambire,* applied to persons who went about soliciting votes in Rome; "acute," and "acumen," from *acus,* a needle; "idea," from a verb describing the act of seeing; "transgression," originally "a going over the line"; "charm," from *carmen,* a song.

To these general illustrations must be added examples of the mimicry by which primitive man dealt with those special abstracts of relation which are of particular importance for the accurate interpretation of Nature — the abstracts, that is to say, of number, time and cause, representing the objective realities of plurality, process and Power. Taking first the idea of number, we shall find that races on a low plane of development have all resorted to essentially the same method of dealing with a relation which could neither be felt, seen, heard, smelled nor tasted. They have provided for it, in fact, by associating it with the image-yielding facts of Nature. They have connected it with sticks, pebbles, shells, heaps of grain, cubes of tea; or they have used, in order to concretize it, modifications of objects, such as knots on a string, notches cut in wood, or marks made with some friable substance upon objects suited to receive them. The essence of the process is that it supplies to the senses sets of images which, being like each other, the mind can permanently associate. Thus three pebbles, or three knots on a string, can be made to represent three sheep which a man has bargained away for some other commodity. The value of such symbols is that they have the same "twoness" or "threeness" of appearance as that shown by the objects which they are chosen to represent, and being objective in character, can be treated by the mind as sense images. The analogously mimetic use of fingers, hands and feet — "hand" being made to do duty for the concept "five," "two hands" representing "ten," "hands and feet" ("one man") meaning twenty — is also widespread among savage and barbarous peoples.[1]

The formation of the earliest number words seems also to have been suggested by the appearance of certain objects which habitually present to the eye a particular number of prominent parts, and thus make a strong image impression upon the mind. In the Javanese, Malay, and Manadu languages the words for one are respectively "seed," "pebble," and "fruit." The Marquesa word for four is *pona,* "knot," so named from the appearance presented by bread fruit, tied in knots of four. The Javanese call fifty a "skein of thread," and give to 400 the term *samas,* which means "a bit of gold." The Abipones, whose name for four was suggested by the toes of the ostrich, also have for five the expression *neenhalek,* originally applied to a hide spotted with five colors. Among the Thibetans, the word for "wing" also means two. Bunches of cocoanuts suggested to the Hervey Islanders their word for five — *kaviri.* In the Yoruba language, the term forty means "string," because cowrie shells, which are used for counting, were strung by forties; the same people employ *igba,* for 200, because a heap of 200 shells made five strings.[2] The Aztec 8,000 is *xiquipilli,* "sack," so named because a sack contained 8,000 cacao nibs or grains. When the inhabitants of Torres Islands wish to speak of 1,000, they use the phrase *o vaturana,* meaning "the leaves of a tree."[3] For certain fractions of numbers, the Japanese employ words otherwise signifying "very fine thread," "sand," "grain," and "dust." Even in modern languages we get survivals of the process, as when in Norse speech *flockr,* "flock," means also five; *drott,* "party," twenty; *thiod,* "people," forty; *old,* "people," eighty; *her,* "army," one hundred.

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[1] Variations of this system may be found in Tylor's "Primitive Culture," also in "Verhandlungen der Berliner Gesellschaft für Anthropologie," 1879, p. 27. Extensions of it are mentioned in Ray's "Api Grammar," and in "The Journal of the Anthropological Institute," 1888, p. 300.

Similarly difficult for the number noun was the concept of plurality. Here we have the idea of number without any of the definiteness which belongs to particular numbers. These can be represented, as we have seen, by particular concrete objects; but how shall the mind fix that idea of indefinite number which is the very essence of plurality? In the earliest period of speech our ancestors dispensed with the conception, or used the singular word in a plural sense, as in the case of such languages as Caraib, Malagasy, Cambodian, and most of the Malayo-Polynesian dialects. But as the plural came to be more and more needed for social intercourse, it was provided for by a sound sign which assimilated the abstract to image-yielding objects cognizable through the sense-organs. Now, as the idea of two is deeply impressed on the primitive mind, owing to the constant visibility of dual organs, such as eyes, ears, hands and feet; and as the concept of duality thus naturally becomes the earliest form of the idea of plurality, the primitive mind hit upon the expedient of doubling the noun — the simplest possible method

[2] Trans. Am. Phil. Association, 1878, p. 29.

[3] "The Melanesian Languages." Codrington.

of reducing the highly abstract thought of plurality to a manageable degree of concreteness, since it made two objects do duty for an indefinite number of similar objects. Thus in Japanese, *yama* "mountain," becomes in the plural *yama-yama;* in Malay, *radya,* "king," changes to *radya-radya;* in Chinese, *yen,* "swallow," takes *yen-yen* for its plural.

The dawning sense of time relations also brought a similar problem in its wake — the problem of making the time concept, formed by abstracting from all activities their common character, conform to the conditions of perceptual cognition. For primitive man, through the necessities of his intellectual life, lived almost wholly in the present. To him such ideas as "past" and "future" were in large measure incomprehensible. For long periods in his history speech had no perfect tense or passive mood. Many races, among them the Eskimo, still use the present for actions in past time. On the other hand, there are tongues, like modern Persian, in which the present tense is made to do for the future. Still more numerous are the languages in which both past and future are very imperfectly represented. Even when the human mind was sufficiently mature to enable our ancestors to conceive of time as being something more than a phenomenal recurrence of light or dark, of sun or star, man still found it impossible to formulate the conception in terms of speech without associating it with ideas otherwise employed in connection with sense-images. Now, the most useful method of so "concretizing" the abstract idea of time was that suggested by its obvious analogies with the percepts of "space" or extension; and thus it comes about that all time words and phrases in every language without exception are founded upon and have their source in the phenomenon of extension. It should meanwhile be noted at the outset that from the earliest times, and altogether independently of speech, there was always this mimicry of "time" characters by the more easily intelligible characters of "space." Thus, before the invention of the water clock, the residents of many ancient cities had their day divided for them by a functionary whose duty it was to march round the walls and announce the conclusion of his journey by the blowing of a trumpet. Or boys were caused to transfer to a new site, piece by piece, a heap of stones the removal of the whole of which marked a certain lapse of time; the hours being measured in the one case by rounds, in the other by heaps. The water clock also effected a rude division of time into terms of space by a process which has only been improved in the modern watch, clock and chronometer. The apparent diurnal course of the sun through the sky, the nightly sweep of the constellations — these are expressions of time in the language of motion which we transfer to the carefully marked divisions of the sundial and the finely adjusted spider lines of the transit instrument. Between the minute spaces on our clocks and the ring spaces which we find in the trunk of the oak there is merely the difference, so far as the measurement of time is concerned, between a mechanism which man winds up daily or weekly, and a horologe that tells of time in terms of the processes of Nature. The necessary involution of the phraseology of space is the same whether we measure time by the loose sand of the hour-glass or by the compressed sand of the ocean bed and the heaved-up promontory. Nor do we cease to resort to space when celestial magnitudes are to be computed; we count immense distances, for example, in terms of that sublime messenger light, saying that a star or a nebula is distant from us by ten, or twenty, a hundred or a thousand, "light years."

This process of "concretizing" the time abstract by a mimetic use of "space" characters begins even in gesture speech. The deaf-mute who would give the present tense to a verb can do this only by making the sign for "here";

to indicate the past tense, he throws his hand back over his shoulder, signifying literally "behind"; the future he expresses by means of the sign for "forward."[4] Similar speech usages have been observed among the most primitive of the speaking races. Thus the Puris, having no word for "to-day," are obliged to represent it by a gesture: uttering the word for "day," they simultaneously touch themselves on the head and point straight upwards—making, that is to say, the sign for "here." When they wish to say "yesterday," they pronounce the word for "day" and point behind them; while to say "to-morrow," they add to the spoken "day" the gesture of pointing forward with the finger.[5] In the order given, the combined words and signs mean literally "Here-day," "There-day" (or "Behind-day") and "In front day." The Hebrew *sham,* originally used for place, with the meaning of "there," was applied later to time, its new significance being "then." The Arabic *beyna yedevy,* literally "between the hands," at first expressed the "before" of space but afterwards came to be used as a "before" of time; "between the hands" of a person meaning either standing before him as to space, or preceding him in time.[6] The Finns have a word, *kausi,* which they employ in the sense of "a piece of time." *Beaucoup* in French may be used for the "many" of time, as well as to describe multiplicity of things. "Just," or "a moment ago," in the phrase "He has just gone out," finds expression in French by the verb "to go," in *Il vient de sortir* (literally, "He comes from going out"). The French *plus* and *moins* are used of time with the same accuracy as is shown in the employment of "more" and "less" for things. The "at once" of *tout à coup* is remotely suggestive of our own English phrase "in the nick of time." The French turn our "in a while" into the more concrete "under little" — *sous peu.* Their way of putting the idea of "immediately" — that is, by a phrase, *sur le champ,* which literally means "on the field," — is as suggestive of space as anything can well be. The form for "where" in the same language may also be used in the sense of "when," as shown on the one hand in the exclamation *Que m'a fait, à moi, cette Troie où je cours* (Racine), where space relation is expressed, and on the other by such a phrase as *A l'époque où eut lieu la paix,* where the relation is that of time. "Near" in French has a similar flexibility of meaning, as may be noted in sentences like *Près du mont Athos,* and *Les beaux jours sont prês de finir. Jusque* (the Latin *usque ad* Gallicized) not only appears as an adverb of space in *Jusque dans les nuages,* but lends itself so thoroughly to the expression of time that the French Academy has sanctioned, and usage made common, the phrase *Jusqu'à aujourd'hui.* The frequent *maintenant,* literally "hand-holding," used with the meaning of "now," is obviously a space-word doing duty for a time relation. In *À Paris,* and *À cinq heures;* in *fixer une chose* and *fixer un jour;* in *J'ai passé la nuit sans dormir,* and *J'ai passé la ville sans la voir,* we get familiar illustrations of the mimicry of time meanings by words signifying space.

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[4] "Researches into the Early History of Mankind." Tylor.

[5] See Ida Pfeiffer's "Eine Frauenfahrt um die Erde."

[6] "Mythology among the Hebrews." Ignaz Goldziher.

German, Italian and Russian are equally rich in examples of a process which pervades the whole body of speech. The Italians say "I have not seen him from two months ago up to here" (*Non l'ho veduto da due mesi in qua*) for "I have not seen him for two months"; "He was there there to strike me" (*Era li li per colpirmi*) for "He was about to strike me"; and "Upon the making of the day" (*Sul far del giorno*) for "At the break of day." The Italian *ove,* meaning "where," is also used in the sense of "if" or "when." "Since when" becomes "From when to here" (*Da quando in quando quà*). *Da* is the Italian "from," both of space and time. *Fra* and *tra* signify not only "between," "amongst," and "in the midst of," but also "after the space of," and "hence," said of time. In German, the word for "future," *Zukunft,* is easily disintegrated into "arrival at," or, more freely, "a coming to." *Zeitraum,* "period," is analyzable into "time-space," revealing a happy conjunction of the two elements under consideration. Such words as *längst, beinahe, schrittlings, nächst, flugs,* also illustrate a class of adverbs with both time and space meanings. The same dual forms are to be found in Russian. Thus *okolo,* "round," or "about," may be used both with object nouns and with substantives of time. *Mwy zhili tam po nedyelam* means "We lived there for weeks at a time," while *Ya stranstvoval po svyetu* signifies "I traveled about in the world," the preposition *po* in each sentence indicating, in the one phrase time, in the other, place. "He died a year afterwards to the very day" is expressed in Russian by "He died the year falling day into the day" (*On umyor god spustya den v den*). *Pod,* "under," has a thoroughly concrete application in *On ukryalsa pod krovlyu,* "He took shelter under the roof," but expresses time in *On priyekhal pod utro,* literally "He arrived under the morning" — that is, "about morning." The Russian *cherez,* "through," or "over," is used for both time and space in such phrases as *On yekhal cherez most,* "He rode over the bridge," and *Ya priidu cherez chas,* "I shall come in an hour." The prepositions *za,* "beyond," and *na,* "upon," originally space particles, are similarly utilized for time relations. Thus for "many years ago" the Russians say "Many years back of that" (*Mnogo lyet tomu nazad*).

The like process might be abundantly illustrated from our own forms of speech. We cannot, for example, talk of "time present," or of "time to come," without using words drawn from our vocabulary of space relations. Such demonstratives as "those days," "that moment," "our times," phrases like "the next day," "the departing summer," "in an hour," "the end of the week," "the first spare moment," "the last day" are simply convenient locutions made possible only with the help of words describing relations of space. Even the tendency to use "less" instead of the more concrete "few," shows that of two words signifying space the mind unconsciously selects the more concrete and therefore the easier. "Past" is simply "passed," implying a movement completed, so far as our standpoint in space is concerned; "present" as clearly signifies that which is "before" one; while the concrete meaning of "to come" is obvious. In such sentences as "the near future," "the remote past," "a long time," "a slight interval," "a vast period," we are in each case using an adjective properly descriptive of a relation of space. In the phrase "There was once," "there" is primarily a space, not a time word. "Before," in "Before it happened," is the same word as that which begins the sentence "Before the walls." The "about" so often used for time relations finds its original spatial meaning in "roundabout." "Age" is etymologically that which goes on." "Minutes" are "smalls," and "seconds" followings. Everywhere we deal with time as a concrete materiality; we occupy it, possess it, spend it, lose it. Time is said to be money, and as we lay up money so we economize time. Times are old and new, near and far off; events take place "on time," as things occur in or on the street; men may be ahead of time as of one another; in "through the year" and "through the town" there are two meanings but only a single preposition.

In the examples given the assimilative process is a means of providing concepts of minimum ease and maximum efficiency. The concrete symbols used in the likening operation are least resistance tools for carrying on mental processes with the greatest gain in result and the least expenditure of effort and time. In the inorganic realm the assimilative process makes things like each other by reducing friction — reduces friction by making things like each other. In the mental realm we assimilate things to ourselves in order to deal with them more easily; there is the same economy when we liken the less familiar, the more abstract, to the more familiar and the concrete as when by likening we call in perceptions of things seen and heard, smelled or tasted, to do mental duty for states or relations which fail to supply perceptual images through the senses. The assimilative process in mind as in matter is a movement away from conditions of differential stress towards conditions of equalized stress. In both realms there is a likening of things to the system, with the result of eliminating conflict in the one and of reducing the expenditure of power to its utmost attainable minimum in the other.

CHAPTER XXX

THE LIKENING PROCESS IN ESTHETICS

The law of assimilation may finally be viewed in its relation to esthetics. We are to realize that, apart from special end, and with qualifications understood, the direction of least stress taken by the organisms is not only the easiest, but also the most agreeable direction. It follows that while there is agreeableness as well as economy in the setting up of structures and the carrying on of activities which conform to the law of likeness, there are a corresponding economy and pleasure in the contemplation of them. This relation between likeness and pleasurableness — between superior ease of movement and the gratification of the esthetic sense — is seen in uniformities both spatial and successional, iterative and repetitive. A more elementary order of satisfaction is gained where activity or contemplation is busied with the simple iteration or repetition of like elements. The higher esthetic pleasure arises when consciousness, challenged by difference, also recognizes likeness. An impression which persists gradually loses its power to impress; an object continually seen gradually becomes invisible; a sound continually heard ceases to affect the hearing. Hence it is that, in addition to likeness, which is always fundamental, the organism requires just so much of superficial variety as shall satisfy the law of consciousness, which demands change. While, therefore, motion towards the direction of least stress is the law for both bodily and mental activities, the law of esthetics is this law complicated by the law of consciousness.

An example may be selected from decorative art, whose like patterns are regularly varied by differences. If iteration were all — if it were merely a question of saving effort by mere repetition — then a series of dots or parallel lines would be the most beautiful object man could contemplate. The effect of beauty is gained in much more intense form when the likeness is complicated with differences. There must be iteration to constitute a beautiful pattern, but there must also be variety to save it from becoming monotonous, and the shock to consciousness which arises out of difference is needed both in construction and in contemplation. It is the orderly union of likeness and unlikeness which makes the square more beautiful than the straight line, the circle or sphere more beautiful than the square. A twirl of the hand, and the circle is drawn, however imperfectly; a square requires four movements, each separately and differently directed. In the line there is no variation — simply an advance in space; the circle continually changes direction and yet through all changes preserves its roundness, each part of it at once like and unlike every other. It is in circles, spirals, and curved lines generally that we obtain the utmost maximum of that likeness which makes for ease of cognition with the utmost minimum of the difference which is needed for the appeal to consciousness. And it is largely for this reason that curved forms such as are met with in the sweeping lines of great bridges, or in the archways of cathedrals, excite the esthetic sense and give pleasure to the beholder.

The symmetries of design and arrangement afford other illustrations of the interplay between the requirement of likeness and the demand for difference. The eye rests with greater pleasure on a scheme which is symmetrical than upon one in which the figures are irregularly spaced and of unlike shape. Cognition of such a scheme is easier. Its elements recruit each other, differing as they do so:

the mind returns, if in slightly varied ways, to the elements it has already perceived; it is saved the effort to readjust itself to something totally new, and is at the same time challenged by something different woven into the texture of the old. The symmetrical pattern in which like elements recur is thus more intelligible, pleases more, strains the cognitive faculties less than would a pattern founded wholly on difference. All this is shown not only in the simpler forms of decorative art, where the elements are little more than repetitions, but also in the elaborate patterns which, made up of elements that at once vary from and resemble each other, constitute so much of the beauty of architecture.

The relation of beauty to function and usefulness has already been suggested in the chapter on "Uniformities of Extension." Organs most fitted to their work — securing, that is to say, the highest degree of economy and efficiency in maintenance — show curved, iterated, symmetrical or otherwise self-assimilated forms, and therefore excite more or less pleasure in the beholder. The beauty of the crystal, the tree, the honeycomb, the spider's web, the bird's wing, does but reappear in the bow, the axe, the scythe, the gearing of machinery, the screw of the propeller, the blades of the ventilating fan, since it is the concomitant of economical, efficient, maintenance-securing appliances. The relation of beauty to efficiency is well seen in the precautions taken to reduce friction and resistance. Says George Iles ("Inventors at Work," pp. 49, 50, 51):

> In stairways the boards on which we tread now meet in smooth curves; so do the walls of rooms as they reach ceilings and floors, conducing to ease and thoroughness in sweeping and cleansing. In outer walls, in doorways, similar curves reduce liability to hurt and harm. . . . Factory chimneys have long been built round instead of square: to-day in the best designs the ducts to a chimney are also freely curved. In blast furnaces this is the rule for every part of the structure, ensuring

> gain in strength, lessening resistance to the flow of gases, and thus saving much fuel. When water pipes varying in diameter are joined, the junction should be a gradual curve, otherwise retarding eddies will arise, wasting a good deal of energy. . . . All the various parts of heavy guns are curved, since any sharpness of angle at a joint brings in a hazard of rupture under the tremendous strains of explosion. . . . A glance at a war ship discovers her varied use of curves in defence; to deflect shot and shell her plates are given bulging lines, her turrets are built in spherical contours, and her casements are convex throughout. . . . There is gain in building breakwaters with an easy curve. To give their masonry and timbers a perpendicular face would be to invite damage, whereas a flowing contour, like that of a shelving beach, slows down an advancing breaker and checks its shock. In rearing lighthouses to bear the brunt of ocean storms the outline of a breaker is repeated to the utmost degree feasible.

Self-assimilated and interassimilated activities, both as carried on and as contemplated, arouse the esthetic sense. All movements produced rhythmically, and therefore with the minimum of difficulty, the maximum of ease, have the quality of beauty; when originated with a maximum, instead of a minimum of effort — as must always be the case when they show unlike duration and interval — we call them stiff, awkward, ungainly, ungraceful. Not only do the assimilated movements avoid the waste of effort involved by unassimilated activities — a waste due to separate mental determinations, as well as to separate neuro-muscular adjustments: they economize the effort put forth in contemplation, since like elements that recur spare the need of changing adaptations to its object by the mind. Note the exercise of dancing, where many of the movements are along curved lines, in which the figures, could they be fixed, would often suggest the symmetries of design, and in which is added to the sensations felt in curved motion the pleasurable contemplation of the curved and rhythmic movements of others. " The beauty of circular motion," says Wölfflein (cited by

Grosse), "is perhaps never more effectively shown than in the majestic flight of birds of prey." Darwin in "The Voyage of a Naturalist" tells us that "when condors are wheeling in a flock round and round any spot their flight is beautiful." Most of us have taken a degree of pleasure in the spinning motions of the top, with its graceful secondary curves; in the gyroscope, which rotates as well as spins; in the revolutions of the otherwise prosaic flywheel.

There is a noticeable qualification without an essential difference in the pleasure excited by natural scenery. We cannot say that the features of a landscape are spread out before us with the simple regularity of an artificially devised pattern. They are in groups; the objects they include may suggest multifarious ideas. Yet much of the difference observed proceeds from complexity. There are meanwhile countless iterated and repeated elements within the irregularity. A rude unity of impression arises even from the *ensemble*. The fact that the admiration of natural scenery is a late acquirement in the history of the race must not delude us into the supposition that because early literatures are lacking in descriptions of nature our modern sentiment towards it has no relation to the likening process. In primitive states of human development the mind finds satisfaction for its esthetic sense only in the most simple resemblances, as these occur in the parallels, zigzags or iterated dots which we find in the art of savages — in the repeated beat of the barbaric tom-tom, or in the recurrent notes, without melody, of all early music. As to primitive peoples our modern musical compositions would present only a confused jumble of irregularities, worthy of ridicule rather than admiration, so to ancient man the landscape, contemplated in the large, must have suggested chaos rather than order, and could not have been esthetically intelligible. It is possibly because of advance in the power to recognize similarities beneath variety, fundamental likenesses in and through superficial differences, that the modern mind is able to take pleasure in those complexes of the regular and uniform within the irregular which make up what we call the beautiful in Nature. Otherwise it would be difficult to account for that subtle fascination which, drawing men to the forest and sea, to the mountain and river, makes real the poet's fancy of

A distant dearness in the hill,
  A secret sweetness in the stream.

For within and beneath all the objective multiplicity and complexity of the landscape there are rich iterations, harmonious repetitions, large symmetries that, appealing to all the senses at once, endlessly emphasize and recruit each other — the rustling of millions of leaves supplemented by the vision of their like forms endlessly prolonged; the rhythmic murmur of stream or sea, mingling with repetitions of sound the iterations of contour which simultaneously reach the eye; the regular undulations of a "rolling" landscape, or the divisions that man has artificially contrived in it; the wide areas of growing grain whose slender stalks flow in wind-chased waves, or the long meadows dotted with daisies; the crenelated zigzags of distant mountains, cutting their iterated patterns into the fringe of hanging clouds; then, between sea and sky thus filled with recurrent impressions for the eye, the rhythmic hum of insects, the slower pulses in the notes of birds.

The beauty of the organized rhythm which we call music — simple as a product of the human voice, more complex when the sounds are given forth by instruments — is also largely a result of the complication of the law of assimilation with the law of consciousness. Melody is undoubtedly indispensable to music, yet it begins, as we have seen, in the simplest regular-interval sounds; melody — variation in pitch and time — is added to relieve the monotony of the one-note, equal-spaced sounds, account being taken of the fact that the same impression continually iterated finally ceases to make any impression: it is therefore a contrivance for refreshing the consciousness with the shock of sensations continually varied. Melody, being superadded, is thus the superficial aspect of music, while rhythm is its permanent element, its fundamental factor, founded on that law of the inorganic which makes iteration, repetition, likeness, the direction of least stress. Whence it follows that melody could be eliminated from music without disturbing its fundamental character. None the less are the most pleasurable effects of musical sounds due to that mingling of the superficially unlike with the fundamentally like which enables the mind to recognize uniformity beneath variety and symmetry within difference.

It may be said that there is something absolute in music, something unrelated to the forms and conditions of time and space. How much? The quality of the musical sensation, like that of the visual sensation, has an apparently unrelated element, and is to that extent *unergründlich.* We cannot say why ether vibrations should cause the feeling of red or blue; all we know is that, given the interplay between the ether and the organism, such and such sensations do actually result. The matter of importance is not the special character of these subjective products, which must vary greatly for different types of organisms, but rather their character as likenesses and differences. None of the notes, melodies, compositions we hear have any label of language that joins them indissolubly to particular concepts, ideas, or trains of thought; yet this very nature of theirs as unchained from the trammels of speech sets feeling and thought free to weave what they will from personal mood and individual experience. As the very vagueness of the suggestion lends itself to the recovery of subtle resemblances unattainable through the medium of bound words, so the indefinite amplitude and massive sweep of the conscious states aroused by music more than make up for any want of specially directed intensity in the momentary impression. And though the same sounds, the same melody, may have unlike suggestions for different individuals, there is for each of them a collocation of sound and feeling that endures. Deeper, moreover, than any personal linking of musical sounds with individual experience is that subtle recovery of race associations which is common to all. Long centuries of contact with Nature have impressed upon us classes of sensations which resound more or less clearly, more or less remotely, at the touch of music. The rustle of the forest, the pattering of rain, the glint of sunshine on lake or sea, torrent-traversed valleys or mountains wreathed in mist, the cloud sailing through deep blue across the moon, morning star and western night-glow, calm of summer landscape and riot of winter storm — all find their distant reverberation in the feelings aroused by musical sounds. Given the rapidly changing shocks required for vivid consciousness — given, therefore, the superficial differences from which they come — then even our unbound and speechless music must be viewed as a vast system of meaning-laden repetitions which, vaguely organized into recoverable classes, their differences dominated by likenesses, captivate the fancy and overwhelm the imagination as they unify man with Nature and make life and feeling one.

The manner in which the rhythms of musical sound and of human speech echo the rhythms of Nature and of art is especially instructive. We hear continually in metaphor of "waves of sound," "rippling tones," "pattering melodies." Weismann writes ("The Musical Sense") of "the mighty ocean of music," "the swell of the waves of music which surged along," and of the parts of a polyphonic composition as constituting "the most charming musical architecture." Similar analogies have been recognized between oratory and Nature phenomena in descriptions of the former, yielding such phrases as: "A combination of cloud, whirlwind and flame"; "The orator rushes upon you in full flood"; "Deep and melodious cadences, as waves upon the shore of a far-resounding sea"; "Every sentence came rolling like a wave of the Atlantic three thousand miles long"; "He loved such far-sounding words as would suggest the long rolling of the wave thundering on the shore"; "He was like a billow of the ocean on the first bright day after the storm, dashing against the rocky cliff and then, sparkling with light, retreating to its home." "It is to the sea rather than to fire," says Frank Byron Jevons ("A History of Greek Literature," p. 139), "that Sappho should be likened, for although her verses are indeed, as the ancient critics remarked, mixed with fire, and her passion blazes out, now here, now there, and glows always, her verses and her passion are oceanic in their depth and tidal in their strength." "To express the quality of Sappho's verse we must borrow a comparison from Sappho herself — it is 'more delicate than waters which make a pleasant noise':

> "A noise like of a hidden brook
>   In the leafy month of June,
> That to the sleepy woods all night
>   Singeth a quiet tune."

That the iterations which thus affect us do not belong to the realm of human artifice, but originate in the deepest activities of Nature, may be seen in that poetic thought of the world which expresses the esthetic feeling in its highest flight. The brook is likened to "chatter and babble"; the rivulet "ripples on in light and shade" to the maiden's ballad; for Geibel the forest is "green-tongued" ("*der Wald mit seinen grünen Zungen*"). In Schäfer's verse the rustle of the leaves and the chatter of the stream are made one; in Tennyson's lines the "myriad shriek of ocean-wheeling fowl" finds its analogue in "the moving whisper of huge trees," and the "league-long roller thundering on the reef." The clouds, in their cumulus, alto-cumulus and cirro-cumulus varieties, are "billowy-bosomed" (Browning) or resemble sheep reposing in a meadow; the waves, likened to dragons by the ancient Egyptians, have been compared by Mörike to "horses of the gods" ("Rösse der Götter), while Kipling intensifies their multitudinous aspect with a metaphor from the chase:

The sight of salt water unbounded —
The heave and the halt and the hurl and the crash of the comber
wind-hounded!

So for innumerable poets the constellations look down upon man with the same "thousand eyes" with which Plato would fain have gazed upon his beloved; so all celestial objects have been conceived of as vocal, from the sun, which in the verse of Goethe

tönt nach alter Weise
In Brüdersphären Wettgesang,

to the stars themselves, in whose song Shakespeare finds heavenly and human harmonies inextricably confounded:

Look how the floor of heaven
Is thick inlaid with patines of bright gold.
There's not the smallest orb which thou behold'st
But in his motion like an angel sings,
Still quiring to the young-eyed cherubims:
Such harmony is in immortal souls;
But while this muddy vesture of decay
Doth grossly close it in we cannot hear it!

The cosmic process, then, so far as we can be acquainted with it, culminates for feeling in the esthetic satisfactions, and these are adumbrated in the very nature of change as a movement from the direction of greatest stress towards the direction of least stress. It is of the nature of the universe as a dynamic system to maintain its equivalences of power, nor does that primordial necessity cease with the production of difference: prolonged into the realm of matter, it takes effect in all collocations and rearrangements thereof. Hence on the elementary dynamic plane the equalities of action and reaction, the "conservation of energy"; hence also on the higher plane the conservation which we call life. The simpler form of maintenance shows itself in the endurance which is inorganic; later come organisms, which, owing to the necessity of death, reproduce their likes, and interact assimilatively in and for association. So also in the case of conscious states: knowledge is the gathering of sense perceptions into classes of likes by a process which is strictly analogous with that by which like objects are themselves brought together into classes or assimilated for association. Feeling depends on difference, for were all objects alike we should not be conscious of them; and esthetic pleasure arises out of likeness complicated with but dominating difference. There is a beginning of this pleasure in cognition itself — the perceiving that objects separated in space are, despite superficial differences, fundamentally like each other; it is more or less distinctly felt as re-cognition, when familiar things are re-seen or old experiences renewed; it takes more intense form in the creative production of likes, as in the artistic imitations of sculpture, painting, the drama and literature: as the statue is a mimicry of the human form, so are the play and the novel mimicries of human life, much of the pleasure we experience in viewing the one, in reading the other, coming from the recognition of likeness. Man loves to fashion the environment after himself: his deities are mainly beings in his own image, and though the anthropomorphism is gradually refined, first emphasizing characters of shape, later characters of consciousness, will and mind, the process remains on its formal side a mimicry of the human self. Nor is this play of the likening process in religion invalidated by the fact that, anthropomorphism apart, we are rationally entitled to find in the universe the fundamental characters of our own being, and of these supremely the teleological character, since without this as sourced in the cosmos an organism could not arise.

Uniformities of time and space, equally spaced iterations and repetitions, self-assimilated curves and movements, symmetries of natural growth that reappear in artificial patterns, all arise out of the working of the universe towards conditions of least stress, out of its molding of material units into collocations that secure conditions of utmost harmony and maximum endurance, and may therefore be regarded as ways or modes whereby the cosmic function of self-maintenance takes effect in the realm of matter. So the movement in life and mind towards likeness, effected as segregation, operating as assimilation, or resulting from voluntary imitation, with or without esthetic pleasure, is one with the Nature movement away from directions of greatest stress towards directions of least stress. The esthetic satisfactions are an outcome of the self-maintaining satisfactions, and are related directly through consciousness to the functional activities of both organism and universe. Our enjoyment of music, in which these satisfactions culminate, may be regarded as an enjoyment of that which most completely imitates the universe process itself — of differences buttressed in likeness, of wholes dominating parts, of unity making itself felt through variety, of order emerging from chaos, of the mechanical pervaded by the purposive. If the cosmos were an organism and conscious it would take pleasure in the conversion of differences into likenesses, of change into endurance; if it were conscious, it would find in the setting up of a star cluster, in the building of a solar system, in the forming of a crystal, and in the construction of the beautiful adaptations seen everywhere in Nature, an enjoyment analogous to that which man has in beholding them.

PART III

ORGANIC PURPOSIVENESS

CHAPTER XXXI

SELF-MAINTENANCE AND ORGANIC CAUSATION

The desert-planted Sphinx, though it wear something of the outward human semblance, is roused to no vital action by anything that happens in its environment. The blast sweeps its sides; heated or cooled, it is in the path of all the tremors of air and the ether, and yields incessantly, however slowly, to the ravages of chemical action. Yet none of these influences excites in it anything more than an inorganic response. Claimed by its rude sculptors for the world of feeling and thought, yet incapable of sensation, potent of motion only as impressed from without, it might well be regarded as a symbol of that inanimate realm into which a new age is now endeavoring to read the characters of life. Bombard the stony mass, and the fragments come tumbling helplessly down, each of them unaffected by anything that happens to the whole, the whole yielding submissively to whatever may be done with the parts. Bombard the tiniest bit of protoplasm with "incident forces," and like a beleaguered city gathering for resistance the system springs to the defense, girding itself against all-comers: almost before our eyes we see it utilizing this influence, fending off that, and developing all those means of continuance which are to distinguish it from an aggregate which is inorganic. For in it the parts and whole are reciprocally implicated: touch the system, and the units feel the shock; disturb the parts, and the whole must either veto or acquiesce. Cut the lowly plant or animal in pieces, and each fragment builds up around it the organic environment to which it has been accustomed. Threaten the higher organism, and it seeks safety by concealment or defense, with pleasure accompanying life-favoring activities, with pain the concomitant of those which tend to injury or death. Out of the impulsion to self-maintenance arise feeling, knowledge and mind, come hope and fear, and in the highest organisms the longing for immortality. The gulf that yawns between the impassive Sphinx and the up-gazing tourist is the gulf which separates inorganic matter from living protoplasm, as the bond which connects them is the link between the causation which is inorganic and that which is organic.

How, then, are we to rationalize the distinction? Not by asking how a many can be a one, though dynamically one the many must be, but rather by considering what must result when one makes up a many. That which is important here is the antithesis of singleness and plurality, of parts and whole. And in any thoroughgoing view we must begin, not with a plurality of conscious beings, the so-called " selves," not even with a plurality of atoms or electrons, but with a plurality of the ether units themselves. For if the universe be a force-exerting system — the great energy reservoir of the physicists — the power which it puts forth in causing change cannot be other than the power of its units as summated in a totality. And if, as already urged, these units are dynamically interdependent — individual, yet collectivized, separate yet reciprocally involved, stressing yet stressed, holding yet held — the accumulated power of all must reflow from whole to part, not only as a power of maintenance, but also as a power of determining change. Here is the primordial subordination of part to whole, the primordial domination of unit by system, with their derivative forms in all material aggregates, whether inanimate or alive. Nowhere do we find the inorganic one indifferent to numbers, but rather yielding and receiving — lifted, as it were, at least partially, out of itself by its association with the many. As unit in an aggregate it is armed with the whole inertia of that aggregate; it then offers greater resistance to impact and moves farther than when acted on alone. And the modification begins earlier than with Ruskin's "little flake of mica-sand" which rose from the weakness of isolation to be "knitted into a strength as of imperishable iron" as the citizen of a granite kingdom. Lothar Meyer ("Die Modernen Theorien der Chemie," Chap. 6, 103) has called attention to the "existence of a connection of some kind between the functions of the parts of a molecule and the composition — using this term in the widest sense — of the whole molecule." If a bar of nickel steel, when put under a drawing strain, hardens that part of the bar which is nearest to breaking, we are compelled to believe that it is the whole aggregate which, if only in an elementary way, resists the threatened rupture. So in the formation of a snow crystal, as Herbert Spencer suggests ("Facts and Comments"), "we are entitled to conclude that the crystallization goes on in each part under the control of all the other parts" — that "the entire aggregate of crystals coerces the molecules in each place, while these in turn join all the rest in coercing those in every other place." Then, with a happy thought whose deep-reaching implications he does not seem to have perceived, Mr. Spencer infers a similar coercive action exerted by the organism as a whole on its parts, remarking as he is about to extend the analogy, "The thing is done, but it is impossible to imagine how it is done." A pertinent suggestion of how it is done for the organism is advanced in "The Cell in Development and Inheritance," where (p. 59) Edmund B. Wilson writes: "As far as growth and development are concerned, it has now been clearly demonstrated that only in a limited sense can the cells be regarded as coöperating units. They are rather local centers of a formative power pervading the growing mass as a whole, and the physiological autonomy of the individual cell falls into the background."

Something of the meaning of organic causation may be gathered from these examples. But the justification for distinguishing between kinds of causation has yet to be shown. Nor need the setting up of such a distinction startle us, for we shall be dealing not with different species, but only with different varieties of the same species — not with two sorts of the cause-effect relation, but only with that relation as showing itself in different sets of conditions each of which forms a class of its own. Inorganic causation may almost be said to define itself by virtue of the fact that it is non-organic. Note first that while the ether units, being constitutively interdependent, require and insist on each other, no such interdependence connects either the inorganic aggregates which arise after the formation of matter or the motion processes in which such aggregates come to be engaged. Solar bodies do not arise in one part of the universe in correlation with their appearance elsewhere; there is no conceivable link between the number of planets in our own system, their orbits, sizes and speeds, and the physical conditions which prevail in the circuit of Vega or Arcturus. The growth of a forest in South America is neither promoted nor hindered by a similar growth in Australia, and either may be destroyed without in the slightest degree disturbing the other. What relation can there be between the chemical process set up in this laboratory and the synthesis contrived in that? Natural products, as already shown, arise discretely; they depend for their possibility not on one another, but on local conditions. For causation in the inorganic is general: the changes which result from it are bound together by no organic end. But in the living body, and none the less really, though less obviously, in the social system, structures and activities reciprocally imply, require, are needed by, and insist upon each other. The universe is concerned, so to speak, only in conserving power; the organism is concerned in conserving itself, and therefore in conserving all those appliances and processes which it must develop as means to self-maintenance.

The differences which mark off organic from inorganic causation are already suggested by the twofold environment, human as well as natural, which man everywhere confronts. Facing Nature and society, he finds himself in the grip of two forms of control. On the one hand he is dealing with things which, as objects, have no organic need of each other; on the other he is dealt with by beings correlated, interdependent, interdetermining, and forming a system of power from which he receives and to which he must contribute. Nature, non-living, is not dependent for its existence on life. Such of its processes and objects as man can utilize he masters; the rest remain either indifferent or dangerous to him. And its incidence upon his activities, whether favorable or hostile, is throughout inorganic. When the natural world blesses him, it is because he has successfully adapted himself: when he feels its curse, it is by reason of his neglect, through failure of his intelligence, or because adaptation is impossible. Around him from electron to star, ministering to him with its uniformities, beating in upon him with its surprises, stretches the natural environment ruled by inorganic causation alone. But within this he is subject to another form of determination in all ways more distinct and in some ways far more intimate — that of an environment whose objects are linked together by organic bonds, and whose causal incidence upon him is collective as well as individual. We have noted this relation (chapter on "The Domination of the Unit by the System") even in the smaller groups of which human society is made up. Observe also how social structures and processes act on the individual with the collective influences accumulated from all individuals. We see these wielded even by the artificial environments contrived by man for his kind. Every stairway he approaches is an invitation, every highroad he builds a direction, every railroad a control, every steamship a compulsion; and all of them turn the individual in the direction in which he must go if he is to go at all. The collective tools which we call machines, the outcome of collective thought and potent with the aid of collective capital, influence our lives in ways both obvious and obscure. How far would the individual be civilized without manufactures, and how would these be carried on without social wealth? It is mutual aid, cumulative through the many and refluent as power to the one which really determines what we shall eat, wherewithal we shall be clothed, in what houses we shall live, and how they shall be furnished. Every useful invention, every improvement of a process, every new degree of efficiency added to the means of individual and social maintenance, comes up from the past and in from the present of the race as a fresh example of the incidence of organic causation. The very institutions that arise to serve us — educational, philanthropic, political — imply the social whole as their *raison d'être,* just as tissue and cell imply the total organism. Strike out the influence of books, and the differences that separate man from the lower animals would at once diminish; abolish newspapers, and the world would break up into isolated communities subject to every wind of differentiation that blew. Ideals of whatever kind contribute to social progress only as they are socially supported; reforms are imposed just to the extent that the reformers win the approval of their community. In all these examples, then, we observe implications of interdependence and reciprocality which are utterly lacking in inorganic causation. We note further that while organic causation depends for its origin and possibility on inorganic, there is so such dependence of inorganic causation on organic. The human individual is not working with the natural environment to keep the laws of chemical combination unchanged, to insure the return of daylight, still less to bring forth Mazzaroth in his season or guide Arcturus with his sons. In inorganic causation we get a multitude of separate incidences no one of which, as object, is immediately necessary to the rest. Organic causation, on the other hand, is the product of contributing numbers — a power cumulative from part to whole and refluent from system to unit. While, therefore, the two forms of control are fundamentally one, each has its own mode and occupies its own plane.

Here it might be urged that as the influence exerted by the social all upon the social each is everywhere implicated with consciousness, social phenomena can furnish only a dubious support to the view of a non-conscious cause-effect relation within the organism itself. But if the modes in which the individual and the society interact are teleological independently of consciousness and will, the objection falls away. It is not by intellectual decisions based on knowledge that human life starts into being and is continued. Men do not choose to be human or even to be organisms. They do not eat because of the reasoning process which convinces them that nourishment is needed for survival. The languages they speak were not determined upon by a weighing of interests either individual or collective. They do not elect to have emotions, to frame ideas, to think in categories, or to carry on mental processes with the aid of logical forms. All these things are imposed upon them. Thus also, wholly apart from choice are given the fundamental methods of human development — the secular sequences of social condition, the ordered evolution of institutional forms — all of them suggesting, by analogy at least, processes within the organism itself. To assume all this as a product of conscious, voluntary choice would be to assume absolute spontaneity in the individual human factors. To set up a fundamental distinction between the modes of the individual organism and those of the social system would be to derive from consciousness the teleology which can be traced only to its source in power. There is organic causation not because the human individual is conscious, not because society is made up of conscious individuals, but because the activities and development of both are determined in advance of consciousness by the nature of the individual and of the society of individuals as self-maintainers, each unit reciprocally implicated with the rest, each individual system-sourced rather than self-sourced. And these individuals, closely associated with each other, coöperate not by election, but because it is their nature to coöperate, just as they yield to the molding and directing influence of the social whole not because they choose, but because they must.

Organic causation begins in the universe for the reason that self-maintenance begins there. Such an origin for both would be suggested by the obvious continuity of the organic with the inorganic. The only conceivable source for material ultimates is the ether, and the uniformity of the ether through all spaces accessible to us is attested by the evidence which shows the uniform speed of light. Matter is found to be made of the same "stuff" to whatever distances it may be explored by telescope and spectroscope; its motions everywhere, so far as observed, conform to the same general laws. That the organisms, formed of matter traceable to the ether, should come forth from the universe as something independent and unique, as embodying characters that appear "for the first time," is a supposition which cannot be entertained without denying cosmic unity. Nor is appeal to a general principle the only resort. The organism, like the universe, is a many and a one, made up of a plurality of interrelated, interdependent, interdetermining parts, all of which are required by each, each of which is insisted on by all. As in the universe, so in the organism, the system dominating is arrayed against the units at once contributing and subordinated. In both organism and universe the power of the whole takes effect as a power of conservation. The general function of every animate system, like that of the cosmos, is thus the function of self-maintenance. But within this likeness an important difference obtrudes. There is a rude form of maintenance in inorganic aggregates, whose cohering molecules offer resistance to disintegration and flexure; yet the parts of such aggregates, as we have seen, may be torn asunder without any disturbance of the molecular integrity of the parts which remain. In the non-living world there is no dependence of the structure of the unit on the structure of the aggregate. A molecule of iron remains such when all other iron molecules have been removed from association with it: the remaining mass of iron continues to be iron however much or little it may have been reduced in bulk. In the case of the living aggregate no such reduction is permissible unless it take place for ends of self-maintenance. Under inorganic causation, that is to say, the molecules have a merely inorganic relation to each other: they act as molecules of carbon, oxygen, nitrogen, phosphorus, sulphur and what not, and the configurations they will assume can be described in purely chemical terms. But when favored by organic conditions a new relation between them begins. What each of the molecules shall do is henceforth determined by what all of them must do; the single properties of the units, in a word, are transmuted, or merged, into a collective property, the property of life. What we envisage, therefore, in life activities as their driving power, is not a "vital force" different from force in general, nor yet the physicochemical properties of the molecules engaged, but just this power of the all-imposing collective character on each, just this superposition of organic property upon inorganic property, just this lifting of matter from simpler forms in which it is universe-maintained into complex forms which are self-maintained. The driving and directing power seen in life is thus the organism as a whole. Vitality adds nothing to the store of energy normally present in the matter of any organic system, nor does death abstract in the least from that store. What happens in the one case, while vital conditions prevail, is the imposition of the law of the whole with which each of the units has to reckon; what happens in the other, when vital conditions finally cease, is the handing over of the system to the more elementary determinations. The difference between organic and inorganic causation cannot be better illustrated than by contrasting the phenomena which characterize a body while it is alive with the processes which go on in it when it has ceased to live. Life descriptively defined is the activities of organic self-maintenance. If a dynamic definition of life were required, we should be entitled to call it organic causation.

And organic causation differs from the causation which is inorganic mainly by the conditions which give to the organism a directing power over its own units and their activities. Interdependence in the ground of the universe is constitutive; interdependence in the organic system is an interdependence of process and structure. The ultimate parts which make up the living body — "electrons," atoms, molecules — are universe-maintained; the structural units into which the organism recasts its inorganic material are originated and maintained by the organism itself. Maintenance in the cosmos is maintenance of the two-sided nature of power; in the organism, needing synthesis and subject to disintegration, self-maintenance is of all the activities and configurations that secure endurance. The living body, like the system which is inorganic, also illustrates the operation of the general process which keeps power two-sided, but upon this in it is superimposed a higher process arising out of the nature of the system as a whole. As in the inorganic the unit of power presupposes the system of power, so the character of every organic unit presupposes the character of all the rest, since it has been built up with reference to their structure and activities: each cell, tissue and organ needs as its *raison d'être* the total system which it serves and from which it benefits. Similarly interdependent also are the organic processes. Not only do the internal activities of the living body demand one another, all of them requiring each, each needing all — they imply, involve and require the relational activities through which the organism adapts itself to and utilizes environment in the interest of self-maintenance.

We face here a sum in dynamics, with the organized structure of all the units overwhelmingly arrayed against unrequired change in any one of them. Any abstraction of parts deprives the units which remain of the internal environment they require as the very *raison d'être* of their own structure and activities. Depletions are necessary as well as accidental, for the organism is constantly undergoing the attritions of wear and tear, and as constantly surrendering of its energy as structure that it may continue active in self-maintenance. But such depletions strike against what may be called the joint interests of the units as interdependent, as requiring for environment a total structure to which each of them has become adapted and upon which all of them insist. Under the tension thus resulting the domination of the unit by the system comes into play; and as it is easier for the system to relieve the strain on it by restoring habitual conditions than by refashioning its whole structure as an adaptation to the new conditions, there emerge from the impulsion of the system to self-maintenance the activities of repair or self-completion, the driving power of the whole organism behind them, as the driving power of the universe is behind the changes we call electrical, chemical, gravitative. Restitution of abstracted units thus takes place not only in the case of cells which have to be rebuilt after yielding their energy for vital movements; it is even more conspicuously manifest in the renewal of tissues or organs that have been injured or lost, as when the snail provides itself anew with a head, the lizard and salamander recreate their tails and fishes their motor organs. And whether the restitution occur with the aid of a nerve system or without it, repair is as fundamentally dynamic a process as is gravitation. It conforms to the mode of all change as a movement from the direction of greatest stress towards the direction of least stress; it is a case of the setting up of equalized stresses by the automatic elimination of differential stresses. Organic self-maintenance thus involves a clinging to structure already set up, repair of parts broken down to yield energy for self-maintenance and restitution in some species of organisms of parts injured or destroyed. Nor are any of these positions invalidated by the experiments which show that tissues, even such organs as the heart, may be removed from the animal body and kept active for days, sometimes for weeks, by providing them with suitable nourishment and other favoring conditions. A flywheel would continue to run if suddenly disconnected from its machine; so the balance-wheel of a watch might be kept in motion after being removed with its spring. But in each and all such cases the wheels would not be functioning as parts of their systems; each system, moreover, would cease to work as a result of the deprivation. A heart may be able to continue beating after its abstraction from an animal body, but as active only, not in any true sense as alive: to be alive it must function as part of the system to which it has become necessary and which has become necessary to it.

Two views of this deeper dynamic design have hitherto been open to us. In anthropomorphic moods we have referred the adaptations and harmonies of Nature to conscious planning by an all-powerful and all-wise Creator figured in our own image either as a colossal man or as an all-inclusive mind; taking science for our guide, we have surrendered the world of the inorganic to so-called mechanical action, attributing its orderly arrangements to the chance workings of physical forces. There has been developed in recent years a similar dualism in our attitude towards the teleology which is organic, for while one class of investigators traces the phenomena of life to a "vital force" or to the summated vital properties of the separate units, another envisages these phenomena as a product of the purely physicochemical properties of matter plus natural selection. We are thus confronted with the conflict between a subjective and an objective interpretation of inorganic Nature on the one hand, between a vitalistic and a mechanistic explanation of life on the other. And we transcend these only by recognizing that bond of common process which, by uniting mechanism with teleology, makes both realms one. Organic purposiveness widens out into the cosmic purposiveness from which it is derived; cosmic purposiveness reappears in the organic purposiveness which is its product and continuance. On the one hand we gain the view of a directing power not separate from things but identical with them — a power which, automatically eliminating friction and disturbance, sets up in stellar, planetary and material systems generally the order and the harmony we call purposive. We find on the other a similar guidance in the organism, due to a like but vastly more complex incidence of whole on part, combining power with the direction of power, and yielding the complex apparatus of intelligent adaptations, internal and relational, through which organic self-maintenance is secured.

It follows that the intelligence which we are so apt to read into universe and organism from the analogy of our conscious activities is not essentially psychical, but fundamentally dynamical. What we mean and can only mean by intelligence is not our consciousness that we are acting in intelligent ways, but the intelligent ways themselves: it is not that consciousness makes what we do intelligent, but that what we do is kept intelligent by modes of action imposed on us by the power system to which we belong and by the organism which is ours. Apart from these modes no intensity of awareness or of will could make any of our activities "intelligent." And if we would realize the meaning of "conscious intelligence" we must seek it at its source in dynamic intelligence — in that universe of power whose ways reveal to us, long before the advent of awareness and will, the self-striving of Nature towards enduring shapes of beauty and strength, with impulses here as delicate as the touch of a sunbeam, there as mighty as the blows of a demiurge.

CHAPTER XXXII

TELEOLOGY AND MECHANISM — INTELLIGENCE IN THE ORGANISM

In Nature we face a cause-effect relation which seems shot through and through with mind, impossible as it is to read mind into the inorganic. How then do efficient causes come to be complicated with final causes, teleology with so-called mechanism? Are they separate, as in the narrower view, or conjoined as in the broader and more fundamental view? It is claimed that a radical difference exists between final causes and efficient causes on the ground that the former involve or imply means, while the latter do not. How far may ways to an end be distinguished from means to an end? End in Nature is maintenance, secured through the setting up of enduring motions, collocations and forms. Even in the inorganic, continuance is attained by adjustments of motion to motion, matter to matter, object to object. The configurations of our solar system show such adjustments; they are seen in the adaptation of atom to atom in the molecule; they show themselves still more conspicuously in the crystal. All of them are at least ways by which enduring, equalized stress forms come to be set up; and were we sure that they had been consciously contrived we should be entitled to call them means. The enormous complexity of organic self-maintenance does expand such ways into means, yet whether implicated or not implicated with consciousness, the process in the one case and in the other is fundamentally the same. Impulsion or striving, illustrating the simplest cause-effect relation or the most complex incidence of the selecting will, it is throughout a movement towards end away from directions of greatest stress towards directions of least stress. The fullest recognition of consciousness in human end-reaching does not deprive the process of its fundamentally self-maintaining character, and men do not voluntarily assume that character — they have it thrust upon them. If it be held that in finality there is a choice of ends, with different ways open of reaching the same end, whereas in mechanical action like causes invariably produce the same effects, the reply is that precisely like causes lead to like results in both organic and inorganic, however difficult or easy it may be to determine the likeness. That different ways of reaching the same end are open to conscious prevision is exactly what we should expect, having regard to the exceeding complexity of the factors: it cannot sever the binding link of fundamental process which connects all kinds of end-reaching.

It is said again that final causes differ from efficient causes for the reason that while in the latter the effect has no influence upon the cause, in the former there is a determination of the means by the end — a sort of influence exerted upon the present by the future. Now what men really do in planning means to an end is to draw upon their past experiences of means and ends: to plan something absolutely new in complete independence of past experiences is an impossibility. The end is mentally projected forward, yet any causal value it may have is not in the future, but strictly in the present as an idea or conscious state. We know from past experience that a blunt knife needs re-sharpening, and it is not any future efficiency of the blade, exerted upon a material object in the future, which determines the sharpening: it is the present sense of a way in which the knife's efficiency may be secured, with the impulsion to end behind it. And if in such case the present could be ignored, it would be truer to say that it is the past rather than the future which determines the means. Nor must it be lost sight of that this looking forward to the future which is so much emphasized in conscious planning also has its analogue and anticipation in the realm of inorganic things. Were it possible to hold that vision is the cause of the physical arrangements which lead on to the eye, it could also be claimed that the geometry of the crystal is the cause of all the collocations that culminate in the crystal. What must arise out of the "properties" of material units and their modes of motion is as definitely prefigured in the nature of inorganic things as are the ends towards which human beings plan and strive. In neither case does the future determine the present, yet in both cases the future is implicit, is involved, in the present, and is to that extent forecast by it, if only objectively. As "ways by which" are the elementary forms of "means by which," so does the looking forward of the conscious planner have its elementary form and anticipation in the unconscious projection of inorganic characters into their results. Either a natural system has a definite nature or it has none. If it be definite, the results which it will work out are predetermined by that nature. And if end can be reached in the inorganic without prevision by any mind, it becomes plain that the fundamental element of conscious end-reaching cannot be its character as conscious, but must be its character as dynamic.

We come here upon the supposed separateness of teleology from mechanism, as well as upon the deeper view which overcomes that separateness; and here the relation of whole to part and of part to whole is radically involved. So long as our attention is concentrated upon the individual case of action-reaction we fail to realize anything more than the simple process by which, through motion, differential stress passes over into equalized stress. The mind which busies itself solely with the unit — with the atom, the molecule, the cell — cannot be expected to find in any of these the meaning of "intelligent adaptations" within the organism itself. Teleology in both organic and inorganic emerges from and requires, not only plurality, but more or less of unity for its manifestation: it is a product, not of the individual unit, but of the system of units; it arises from the potencies of all of them, and yet is not a mere summation of those potencies; involve as it must the contribution of each to all, it is the dominating guidance of each by all. The difference between the merely mechanical and the purposive is not the difference between physical causality and something altogether unlike it superadded: in a broad sense it is the difference between the partial cause and the total cause, between the unit acting separately and the unit acting under the domination of the system. Even in gravitative action, where the problem is presented in its simplest form, it is impossible to explain the coming together of material bodies on the hypothesis of merely accumulated or summated individual characters: it is only when the universe as power system is called in, substituting for a supposed private relation between such bodies a relation between them supplemented by their relation to the system, that their motion towards each other can be rationalized. Nor is there in the nature of matter, as narrowly conceived, any explanation of the harmonious adjustments of magnitude, place and movement exemplified in our solar family. What help do we get from the merely individual properties of molecules in our effort to realize how the tiniest snow-crystal comes into being? So-called attraction and repulsion as individualized give no key to its symmetrical structure, and we invoke polarity in vain. Each unit seems to know how all the other units are behaving; each takes up its place as unerringly as if that place had been assigned to it in accordance with an original plan. The result manifestly depends, not on each unit acting out its nature independently of the rest, but upon the acting of each under the dominance and guiding of all. In the organism also the action-reaction relations needed for the final grouping are the contribution of the individual molecules; the directing of their properties is the work of the total system. It is out of this " concilium " of units, each submitting itself to the rule of all, that purposive activities and forms take their rise and the system develops its means to self-maintenance.

The real artificer of the organs, the real organizer of the internal processes, is the organism itself, functioning as a time-and-space whole. And it is artificer and organizer not because it determines that change shall take place away from directions of greatest stress towards directions of least stress — that is the mode of motion in both inorganic and organic — but because its nature as a self-maintainer determines the kind of change in which the law shall have manifestation. The mind of the human artificer, in making a tool or machine, holds consciously within it the end to be reached and the means by which it may be reached. In the organism the equivalent of these conscious factors is that which underlies and makes them possible — the nature of a system which, made up of complex, mobile, interdependent units, each of them subordinated to all, all of them dominating each, must develop activities of self-maintenance once its structural integrity has been challenged, so to speak, by depletion. Threatened in its earliest stages by so-called fission, each product of the division is under urge to complete itself, and as the need of taking in materials from without brings on movements in relation to environment, the system gradually develops, along with internal processes for absorbing and assimilating nutriment, activities of locomotion with their appropriate organs, the organs of sense, requisite nerve connections and finally a brain. At the outset the organic aggregate completing itself works out its own renewal and carries on the incipient activities involved; later, as these grow more complex, the system differentiates itself into soma and germ-plasm, the soma as means to the vital activities, the germ-plasm for the work of reproduction. In the simpler stage the only break in the life history of the organism occurs at division; the later stages involve the death of the soma at the close of the cycle imposed by heredity. And advance from the one to the other, like the advance from self-reproduction to sex reproduction is an advance towards increased economy and efficiency not unlike that which men secure for industrial activities by separating functions that clash with each other in the so-called division of labor.

It must be remembered that the kinds of activity needed for self-completion and for the more complex forms of self-maintenance are prefigured, as it were, in the very nature of organic matter and its total conditions. If the system is to maintain itself it must take certain general, one-way routes to the goal, certain as it is that there will be superficial departures from these, once the fundamental directions have been set up and established in structure. Paths of greatest and least stress in maintenance thus exist away from which and toward which the organism must move in its development, involving functions as definitely marked out and imposed in advance as if they had been consciously planned. And in the fashioning of organs for these functions the rule of all change comes into play. The organ is in sort a generalization of all the activities which it performs; arising out of the nature of the system which it serves, the immediate product of those activities continually iterated, it advances from its incipient to its most economical and efficient form by motion away from the direction of greatest stress towards the direction of least stress, involving automatically the substitution of conditions of equalized stress for conditions of differential stress. Any removable inadequacy of the means, any eliminable waste of power in the attainment of the end, operates as so much differential stress impelling to change, and the change goes on until the inadequacy is corrected and the waste removed. The units in functioning meet with the least stress in the direction of the configurations which are to constitute the perfected organ; they meet with the greatest stress from every other direction. It is by imposing a special activity in each case that the system determines what these directions of least and greatest stress shall be: the units are therefore impelled towards the one and away from the other by a power which automatically bears down on activity, position and form, on cell, tissue and organ until conditions of equalized stress have been set up — until, that is to say, the appliances needed for self-maintenance have reached their most efficient, their most economical, in a word, their least resistance forms. The constituent parts may be as self-active as we choose to think them, but they must yield to the power of their own accumulating — must comply, each as a one dominated by a many, with the requirements of a system predetermined by its nature to maintain itself. And in the transformation by that system of their elementary ways into means, in its compulsion of them into purposive activities and forms, in its imposition of the complex teleology of life upon the simpler teleology of Nature, we see at work a guidance which is the anticipation, and also of the very essence, of conscious artifice in man. For the tool and the organ emerge out of fundamentally like determinations. In each case there are the impulsion of the system to self-maintenance, the conditions of maintenance, internal and external, and the directions of greatest and least stress. As undue friction, resistance and waste are involved by the use of an imperfect tool, so they are encountered in the use of an imperfect organ; there is thus for both users — consciously exerted in the one case, unconsciously put forth in the other — a differential stress which produces change until the faulty appliance has reached its efficiency maximum.

Nothing more than a suggestion of the manner in which animal life began can be hazarded. Protoplasm, let us say, was formed in a medium fluent like water by the gradual aggregation of such materials as carbon, hydrogen, oxygen, nitrogen. We must assume that from the synthesis of simple molecules highly complex supermolecules took form, establishing through their interdependence a contribution of part to whole, a domination of part by whole. The life activities of such a system began after fission with the movements by which the products of division completed themselves. The system was fluent and flowing in the medium by which it was bathed; it obtained by touch, by contact, the nutriment which was to serve it for regrowth, coming into contact with substances indifferent, favorable or injurious to maintenance. In the case of substances favorable — food substances, that is to say — the reaction of the system on contact, the partial or incipient mingling of substance with system that preceded assimilation, would be easier for that system than contact with a substance useless for or hostile to it. The commencing organism thus acquires its first experiences of environment through unavoidable contact with objects, to which it applies the physical test of ease or difficulty for assimilation. As the ease of dealing with assimilable substances is actually a preference for them, so the difficulty of dealing with non-assimilable substances is tantamount to their rejection: this ease and this difficulty, moreover, are gradually converted into the shocks and commotions which we call feelings. The guidance, that is to say, is first that of mere physical ease and physical difficulty; through the development of awareness it finally becomes a guidance of sensations agreeable and disagreeable, such as, beginning in selection, finally culminates in activities of search and pursuit. Activities in relation to environment are involved throughout, and these may begin with the simplest kind of reaction from buffetings and distortions due to the medium; once originated, they gradually take on purposive character. Motions disadvantageous for maintenance are *ipso facto* the most difficult; movements favoring maintenance are easiest, obtain repetition and get themselves organized. There are thus directions in which motion, molecular and molar, must become habitual, other directions in which it cannot become habitual; and it is from this objective preference for the one, this objective rejection of the other, that the first teleological adaptations of activity to environment take their rise, to lead from simple expansions and contractions of the system to cilia or flagellae-like structures and ultimately to the higher kinds of motor organs.

Some idea of the procedure for both internal and relational activities may be gained from the unconscious forms of purposiveness in man himself. Attention has been called by psychologists to a process which Prof. E. J. Swift ("Psychology of the Day's Work") describes as "the law of the unconscious adoption of method" in his account of the way in which difficulties are met in business and the professions. "The situation is urgent," he writes, "and there is always a tendency to meet it with an economical use of energy. This frugality of energy does not indicate intentional slighting of difficulties. It is a phase of unreflective adaptation to them. In the acquirement of skill . . . this adaptation is so strictly unconscious that the learner is not aware of the particular method he has adopted until he finds himself using it with more or less success. . . . The plan unconsciously adopted to meet an emergency in acts of skill is usually the one requiring the least expenditure of energy (p. 7). . . . There seems to be a competition of methods. Just how a selection of the efficient method occurs without conscious interference it is difficult to say (p. 130). Other writers quoted by Professor Swift give details of the experiments. L. E. Ordahl found that "methods changed and improvements appeared without conscious control," and W. F. Book states as a significant fact about learning that "all adaptations and short cuts in method were unconsciously made. . . . The learners suddenly noticed that they were doing certain parts of the work in a new and better way, then purposely adopted it in the future" (p. 131).

If fully developed human beings may hit upon correct methods of adapting themselves to novel situations without any discoverable aid from plan aforethought or end held consciously in view, a similar method of adaptation should be possible in the lower animal world, where deliberation, choice and consciousness are much less in evidence. What really happens is that, whether automatically or by the trial and error method, the organism sooner or later executes the movement which results in the satisfaction of desire — desire which is the outcome of need, as need is the outcome of the impulsion to end, — and that success in such movement, being stored up in the memory, leads to repetitions and thus to the setting up of a body of rules which, as so many habits of action and reaction, governs the relations of the system with its environment. The ways of acting and reacting thus organized in the lower organic forms constitute in the higher the groundwork of conscious choice and planning aforethought. There is thus for the living system, when it comes to work consciously towards ends, no *de novo* reaching out to ways and means, but a planning based on the guidance of organized past experiences, with deviation taking place only for variations within the general classes of such experiences. And what is true for the lower animals in this respect is true also for man: advance in the making of tools and machines is never a leap to something totally new, but rather a new step based on and utilizing past achievements — a progressive variation from class foundations and within class foundations already laid down.

We have hitherto failed in our comprehension of life mainly because we have been involved in the absolute method of dealing with things — have been more intent on discovering what units are for themselves than on finding out how they are related to and influenced by the systems to which they belong. Here is suggested the difference between two ways of viewing a picture. Examined microscopically, it yields nothing more than minute depressions or elevations of the paper, peculiarities of its texture, or at best no more than minute areas of light and shade that are without meaning when studied apart from the total area. It is only when we view the picture macroscopically, so to speak, as in naked eye vision, that its significance comes to be revealed. It is intelligible only as a whole, and it is thus intelligible because the various individual details now get the supplement, reinforcement and illumination of all of them. And it is this completion of part by whole, this contribution of whole to part, which we need for any sufficing view of the universe and for any adequate interpretation of the organism. Nor need we shrink from concerning ourselves with the relation of whole to part in the supposition that to do so would be to pass from a positive to a speculative, even mystical method of inquiry. "Vital force" is not here in question; there is no mysterious "perfecting tendency" imported into the problem. What is needed is not a forsaking of the objective attitude towards the facts, not even the giving up of the "physico-chemical" side of vital phenomena, but only an extension of the scope of inquiry from the units to the system. After all "energy" explanations have done their work, the fact of control and direction awaits elucidation, and this can be traced only to the organic system as a whole. If the organic processes go on under the régime of a domination of part by whole, no fear of "vitalism" need delay the scientific recognition of them as inherently purposive. The process is dynamic in character, and inquiry into it is generically of the same kind as inquiry into any chemical or physical phenomenon.

CHAPTER XXXIII

END, FUNCTION AND MEANS

We shall now need to set aside the assumption that the "behavior" of the living aggregate is of so special a kind that it cannot be included within ordinary dynamic conceptions, as if the life activities were somehow superposed upon a system which would behave very differently were it, so to speak, "left to itself." Those activities are just as natural to it as "affinities" or "properties" are natural to the atom; it is just as inevitable for the organism to develop intelligent adaptations as for the electron to join in the formation of atoms, for atoms to merge into molecules and for molecules to give rise to the various chemical substances. Self-maintaining activities, that is to say, are the organism's normal way of behaving: it has the property we call life.

Once formed, the protoplasmic aggregate, endowed with the function of self-maintenance, confers subfunctions on its parts, with the result that they are gradually specialized for the internal and relational activities. How are these subfunctions imposed? By virtue of the constitution of a system whose nature it is to resist reductions or modifications of itself and to manifest that resistance, whenever its integrity is threatened, at first by activities of repair and later by all the other activities in which it is involved by repair. Such an aggregate has prefigured in itself directions of least stress towards which it must move and change, if at all, and it is motion in these directions, due to greater stresses from all other directions, out of which the processes, activities and organs needed for life arise. The ways in which it shall accomplish self-maintenance are also prefigured — dictated, as it were — by the nature of matter, organic and inorganic, by the character of the environment, by the law according to which change must take place, and by the whole of the conditions. For all but activities that are conscious, the process goes on without awareness of what is being done, yet it proceeds as if an artificer were working out the results by plan aforethought and with complete command of the material.

Here a difficulty arises. How can means be contrived for ends unless there is awareness of both? No consciousness is needed where the motion or the collocation is simply the effect of causes determining ways: it is thus that a crystal is built up and a solar system evolved. In these cases the changes produced are ways to end: they are imposed and need not be contrived. But when means to end are required the problem differs in character. How is a marine organism guided to the modification which initiates the development of a fin, or a land organism to that which begins the development of a foot? In neither case has there been any experience of "means by which"; in both there seems to be a complete beginning *de novo*, a sort of plunge into the unknown, all the more mysterious because it seems to have no adequate guidance behind it. In reality, no such guidance or experience, beyond those of organic impulsion to end and the total conditions, is needed.

Our own way of working out human purpose is to have both end and means consciously before us. We therefore assume that wherever end is reached by way of means the process is conscious, or that somewhere, somehow, consciousness is involved. But being unable to discover consciousness in a plant, or in the internal processes by which animal organs come to be developed, we look about for some other cause; then, realizing that "fitness" in organisms ensures their survival, while "unfitness" leads to their elimination, we try to explain the fitness by referring it to fortuitous variation: as no individual organism exactly resembles its parents it is taken for granted that some of the changes which appear must favor survival and are therefore preserved. How can there be two kinds of organic end-reaching, two ways of bringing intelligent adaptations into existence, two processes of compassing ends by way of means, each separated from the other by a total difference of kind — the purposive way, revealed in the organism by its internal and relational activities, there unconscious, here conscious, and a chance way by which the organic units get their purposive character fortuitously through the survival of variations which only happen to be useful, but are not made to be useful? Is it rational to believe that chance can be operative as a prime factor in intelligent adaptations when purposiveness is there to explain them, and do not the two apparently unlike kinds of end-reaching, the one voluntary, the other unconscious, coalesce into a single method the moment they are examined? As will be shown more fully later, the reason we are conscious of both means and end is that our relational activities involve us in the shocks of continually and suddenly changing adjustments to environment. The sessile plant, experiencing no such shocks, is not quickened into awareness of what it is doing; so the animal, in the development of its organs, as in the carrying on of its internal processes, is engaged in activities that have a "block" character, that constitute what may be called one-way routes, that are not broken up into variations and vicissitudes and do not, therefore, shake the system into awareness of them. End-reaching is obviously a single method in all organic activities, whether consciously or unconsciously performed; it becomes conscious not because consciousness is essential to purposiveness, but because and only when consciousness is demanded by the conditions.

From the foregoing it follows that there is not only a conscious, but also an unconscious form of end-reaching which uses means for its method. Ways to end are developed into means by the complexity of the activities needed for the attainment of organic end. In the realm of the inorganic end is reached in simple and direct fashion, as by the fall of an object to the earth, by imposed motion in any given direction, by the collocation of material units originally apart, by the setting up of systems of aggregates in moving equilibrium. But in the organic, where end is a complex of activities, the goal cannot be reached in such simple fashion: it requires the calling in of some object or process through which the result may be attained — in a word, the interposition of means. It will be said that there is no prevision in either of end or means; it must also be said that the place of prevision in conscious planning is taken in the case of activities which are unconsciously purposive by the nature of the system as a self-maintainer and the total conditions. What would our own consciousness avail if the organism were not impelled to ends of self-maintenance? The whole complex of human planning, of man's adjustment of himself to environment, of his utilization of things useful and avoidance of things harmful, thus arises and is thus buttressed. And it is this original endowment, not the product of consciousness or will, which is behind and beneath the organism's resort to means in the development of its internal processes and appliances, as it is behind the activities known as instinctive.

Let us now consider the origin of organs which, constituting means to end, are developed unconsciously, beginning with one of the most difficult of the cases to be explained, that of the organs of vision. These arise, it is reasonable to assume, in a protoplasmic surface naturally, not fortuitously, sensitive to light, and the system makes the best possible use of the incoming rays for its guidance. By use, with the law of maximum economy in operation, differential stress prevailing until maximum efficiency is reached, the work of dealing with the vibrations is gradually abstracted from the whole of the surface units to some small area or areas of them. Gradually also the mechanism of reception is improved: the organ takes shape in various species as "eye-spots," "eye-dots," "eye-bulbs," as ocelli, as "multiple" or "compound" eyes, many of them with differing life histories and methods of development, but all functioning to use light in the interest of self-maintenance. And out of this striving towards end, giving ultimate rise to the perfected lens, retina and optic nerve, comes finally the wonderful vertebrate eye possessed by many of the lower animals and by man. Nor does the process differ for the organ of vision from that which presides over the development of the fins of a fish or the wings of a bird: in all such cases, given the impulsion to end, to self-maintenance, the final stage is reached by the working of the parts engaged towards conditions of least resistance, and therefore towards the configurations which represent the maximum attainable economy and efficiency for the activities carried on.

Is there a similar working out of means through function and use in plant adaptations? To most of these a natural selection origin has been ascribed almost without question. How else, it is asked, may we explain the means taken to secure the dissemination of seeds? We see them sometimes propelled from the plant, as in the case of the vetch, the witch hazel, the acanthus and the "squirting cucumber." For distribution by the wind the maple and the pine wing their seeds; hairs, plumes or other fluffy appendages are employed by the clematis, the cotton plant and the dandelion. There are "hooks," as in the burdock and the grappling plant, by which the seed is made to adhere to passing animals; some plants combine their seeds with fruits to tempt the appetite; note also the numerous adaptations of color and form in mimicry, the many modifications of plant structure developed to ensure the aid of insects in reproduction. Can it be said of any of these that they have other than a chance origin or that they owe to use their gradual improvement from beginnings? Take as typical of most plant adaptations in this class the plume of the dandelion seed. Far enough as the case may seen from development by use, its beginnings do not separate it from those of the eye: as the organ of vision commences with the sensitiveness to light already present in a protoplasmic surface, so the seed may be assumed to begin with undeveloped hairs or hairlets on its periphery; as the protoplasmic surface deals with the ether vibrations which reach it, so the seed hairs deal with the action on them by the wind. Nor is the seed some limb or fragment thrown off by a parent body; it is itself a complete though as yet undeveloped organism, and may be assumed to have its own commerce with environment. The seat of an impulsion to self-maintenance, it also has a set towards the adaptations which will promote survival; it no more needs to know that a hairy or plumous appendage will favor its striving than the surface sensitive to light needs to know that certain rearrangements of its molecules will confer on it the power of vision.

Do the beginnings of intelligent adaptations enable the organism to survive as against organisms which have them not? In most cases the survival advantage would be so trivial as not to count, especially in view of adversities which carry off fit and unfit alike. It must be assumed throughout that the success of a variation in promoting survival does not depend on the appearance of it in a single organism. Intercrossing with other organisms would then swamp the improvement. Taking into account panmixia, welding all individuals of a species into close interdependence; taking note also of the likeness of the general conditions for the species as a whole; the conclusion seems inevitable that intelligent adaptations would arise not in one, but in many organisms simultaneously. The swamping-out process would thus be inoperative, and the purposive variations would recruit each other. But without the purposive process no survival would impel them forward in a definite direction. Once they had appeared on the wider than individual scale, the favorable variations would undoubtedly be inherited: the whole possibility of the evolution of life forms from higher to lower is bound up with and depends on such transfer.

Meanwhile there need be no denial of the fact that some purposive adaptations have their origin in chance. But the concession must be made with reservations. An organism which "happens" to have the same color as its environment will be preserved, to the exclusion of another whose color, being "conspicuous," invites attack: would the protectively colored individual which survived pass on the advantage to its offspring? Concede that this kind of happy chance was vouchsafed to many members of the species. What would such a method really mean? It could not mean anything of the nature of a substitute for the purposive process on which it rests and which it subsumes as its precondition. In calculating the result of a lucky variation we take for granted an organism already in existence, endowed with means to survival and working purposively towards survival. Beneath all such possibilities is the nature of the living aggregate working towards end: apart from the impulsion to self-maintenance, no accident, no fortuity, could be of the slightest avail in producing an intelligent adaptation. Chance conditions of growth may give the branch of a tree the form of a club, and it may be used as such; stones may be so fortuitously shaped as to lend themselves to utilization for building. But as the club implies a wielder and the wall or house a constructor, so does the chance variation which the organism utilizes imply an end-reaching system.

In the case of protective coloration, moreover, we must not hastily assume that this kind of intelligent adaptation is beyond the power of the organism to produce for itself. Professor J. Arthur Thomson ("The Wonder of Life," p. 29) mentions "the power of color-change" which even the animal has, within certain limits, of "adjusting itself to the particular hue or even pattern of its surroundings." He instances, among other examples, the cases of the flat-fish, the plaice, the flounder and sole, "which can adjust the shade and the pattern of their upturned surface so that they become practically part and parcel of the sand or gravel on which they are resting." And the same student of Nature seems to warn against the supposition that all correspondences between color and environment have necessarily originated through natural selection by citing cases in which animals "actively seek out the surroundings with which they best harmonize with certain backgrounds": "a woodcock or a curlew upon its nest fades into its environment and becomes practically invisible, just as does the brown lizard on the sand, the green snake among the branches, the transparent arrowworm in the sea, the mountain hare among the snow, the hare on the ploughed field." Are we always able to distinguish between cases in which the organism has put on a particular color for the sake of concealment, and the cases in which, with the color no more than an accident, it has simply sought the protection of a particular environment?

Passive as it may seem, the plant also needs to utilize external objects and conditions — sunlight, the wind, characters of soil and atmosphere, the busy life of insects and animals. The root which progresses underground, the stalk that shoots up into the air, the tendril clinging or winding wherever there is an object to be grasped —

these are motile in a more than formal sense. Passivity, activity, are relative conceptions in the world of things organic. Both plant and animal must work relationally as well as internally for self-maintenance. The complexity of self-maintenance in the one case, its comparative simplicity in the other, suggest to our distinguishing faculty two orders of behavior which for the objects themselves do not exist. The thing essential in both plants and animals is that in both function is imposed on the parts, that in both the working of the parts for function is an internal process whether the organism be fixed or motile, and that as a consequence, within the bodies of both plants and animals, the requirement of motion away from conditions of differential stress towards conditions of equalized stress asserts itself. And this is also true for the so-called "mechanical" reactions of the whole system known as "tropisms": these, as the very condition of their possibility, presuppose an organism inherently purposive from the beginning. Considerations like the foregoing apply with equal force to all cases in which means to ends are unconsciously developed in both plant and animal life. But a complete study of them should include purview of what may be called the unconscious attitude of the organism towards the self-maintaining urge within it and the total Nature conditions of which it must take account. Both plant and animal are time-and-space systems, and have a time-and-space process which does not easily lend itself to comprehension by what we call knowledge. The changes and shocks that make us conscious of things create a "present" which vanishes as soon as it is experienced and can be recovered only imperfectly in memory. Conscious memory, moreover, is only an occasional exercise; in the very recall we bring to view no more than a succession of past presents snatched, as it were, from the very surface of life. There is a deeper nature composed of the total character of the organism, of its inner workings and purposive trend, which we neither know as we act nor recover when we recollect. It is this time-and-space whole which escapes us, which evades even the most exhaustive biological study of the organism that is engaged in the work of originating and developing its intelligent adaptations.

How much is the unconsciously purposive process in organisms lacking of the method we follow in our reaching out to ends by way of means? May not the fundamental nature of it be there even though no awareness illuminate it for the system which is engaged? Are not all bodies, inorganic and organic, held to initiatives and responses under the influences which reach them from the external world, whether such influences stir them to consciousness or not? Paulsen, in his "Einleitung," writes of *die universelle Rücksichtnahme aller auf alle,* as implying a taking account in nature of everything by everything; Leibnitz, in the "Monadologie" (61) tells us that "each body is aware of what is happening in the whole world, so that anyone who could see everything would be able to read out from each single object what is going on everywhere, also what has happened in the past and will happen in the future, thus perceiving in the present things far off in time and space." The actual relation between things transcends what Paulsen had in mind and falls far short of Leibnitz's far-fetched and fanciful supposition. But there is a middle ground between the two views which may be adopted without hesitation. Recall for realization of it that in the living and non-living we face the universe of power and the organism which arises thence, each made up of units subordinated, with the whole of them dominating. For the inanimate object the whole is the total cosmos; for the living object the whole is the total organism. In both the power contributed by each to all, and refluent from all to each, insists dynamically on the continuance of the system, imposing non-vital motions and configurations in the one case, imposing vital activities and structures in the other. The inorganic material world is thus made up of units and aggregates that are maintained and have their motions determined by the universe; the organic world is made up of systems that, while maintained by the universe in their character as matter, are also determined to the self-activities and structures needed for maintaining themselves as organisms. In both realms the régime of motion away from the directions of greatest stress towards the directions of least stress prevails. But in the organism, as the result of its impulsion to self-maintenance, these directions become directions towards the activities and structures which secure self-maintenance and away from the activities and structures unfavorable to self-maintenance. The organic units, in other words, have a new rule imposed upon them by the whole which they form and to which they contribute — the rule that motion and change shall be easier for them in the direction which favors the continuance of the system, more difficult for them in the direction which is unfavorable to that continuance. And it is because they are thus under the régime of organic end, as distinguished from the régime of inorganic end which prevails elsewhere, that the organism is alive and that it develops the processes and appliances which enable it to accomplish self-maintenance.

However subtly, however obviously, therefore, even the inorganic object "behaves" exactly as it should, having regard to its own nature and the totality of the incident forces. In advance of and independently of consciousness, the organism also faces a dynamical problem, and solves that problem by giving to its ways and modes the direction dictated by the impulsion to self-maintenance and the whole of the conditions. Making full allowance for the quasi-spontaneity of the living aggregate — its liberation from purely inorganic determinations into a higher kind of action-reaction — it must be held that even in the organism the total factors are automatically operative, and that there can be no evasion of the " behavior " which the whole of them require. Purposive activities directed to self-maintenance, let it be repeated, are as inevitable for it as are particular combinations for the chemical atoms and the particular substances which they unite to form. Reaching out to end by way of means is imposed on the plant as rigorously as on the animal, and the directive insistence at work, proceeding from the totality of the factors, is of the same kind whether a seed is being winged for flight or an incipient eye improved for vision.

CHAPTER XXXIV

DYNAMIC MEMORY, OR HEREDITY

ORGANIC causation, visible in all the manifestations of life, gains its simplest and most direct evidence from heredity, from dynamic memory — a phrase the very contradiction in which appropriately implies that the process which finally comes to be associated with consciousness is originally and fundamentally preconscious. In dynamic memory we are dealing with a system which determines what its units shall do and be not merely as a space-whole, existing in the now, but also as a time-whole, and therefore with a causation which is made up not only of what the organism insists on in the present, but also of what it has done and insisted on in the past. Heredity also has its roots in the vast realm of the sub-organic from which the living body itself emerges. An elementary form of it is disclosed in the relations of the atoms and molecules within the gross bodies which they unite to form. A piece of vulcanized india rubber does not immediately return to normal dimensions after it has been stretched; a tuning fork kept vibrating has a tendency to become viscous or imperfectly elastic; so many other elastic or imperfectly elastic bodies show the survival of influences that have acted upon them. A kind of time-order has even been noticed in the recovery of solids from so-called fatigue. Torsion applied to glass fibers produces a permanent set which varies with the time of the action of the force applied. If a wire be twisted through 90 degrees to the right for six hours, then for half an hour to the left, and be then so gradually let go as to avoid oscillations, it turns slowly towards the right, gradually undoing part of the effect of the more recent twist, then stops and twists more slowly to the left, thus undoing part of the quasi-permanent effect of the earlier twist. "The behavior of such a wire, strictly speaking, is an excessively complex one, depending as it were upon its whole previous history, though the trace left by each stage of its treatment is less marked as the date of that stage is more remote." ("Properties of Matter," Tait, p. 219.) In none of these cases do the molecules have their structure changed as such; all that happens is that their normal relations to each other are more or less altered, involving a slightly changed configuration of the system. But the effect is only temporary: gradually the older and longer enduring relations are restored. Prior recovery from the recent stress, ultimate recovery from the earlier stress — these probably mean that the solid releases itself from a stress to which it has only imperfectly adapted itself, last from the stress which, however temporarily, has imposed upon it certain new configurations.

Now it is this incipient time process in inanimate matter which comes to be expanded and writ large in the organic system. The most familiar example of causation by a time-and-space system is seen in conscious memory. Here is encountered the ease of repeating something "learned by heart" in the order in which it was acquired, and the difficulty of deviating from that order. How does the acquired order come to be preserved and to assert itself to the exclusion of all other orders? Manifestly it is a sequence of change to which the brain system has adapted itself in the successive acts which constitute "learning by heart." These acts are ultimately molecular motions, and the brain which accommodates itself to them in the end insists upon them. The order acquired comes to be cumulatively easier than any other order for the reason that it has in its favor, as against all other sequences, the power of the brain as a whole. The difficulty of reversing the order — at a minimum for simple elements, such as the letters of the alphabet — increases with the complexity of the material acquired, as when from mere verbal juxtapositions the mind passes to the acquirement of involved sentences; it becomes insuperable where the mental adaptation is accompanied by highly complex neuro-muscular adjustments, as in the playing of instrumental music. The "habit" thus set up, like all habits, is plainly due, not to feeling, consciousness or will in the individual molecules, nor yet to choice put forth by the conscious subject, but to the necessity under which the brain system is, as many and one, as individual and collective, of first accommodating itself to an order of change within it, then of insisting on that order with the power of the whole arrayed against the power of the part.

Another illustration may be borrowed from the military evolutions of large bodies of men. Here, as in the case of the brain, there is a combined space-and-time determination. From the beginning each individual is at once in a space-and-time relation to the system of individuals — is in some place within the system, and has reached some time point in the total process of its evolution — is passing from some occupied position to some position to be occupied. In what he does, therefore, at any particular instant and in any particular place the individual is governed by the whole of the changing configurations of the system as time-and-space totality: kept thus obedient to the imposed order of change, he is restrained from varying therefrom by the summated power of all the men engaged. To say that they reciprocally and locally determine each other's movements does not meet the case. Two men moving in whatever order are free to change that order. In closely compacted ranks none are physically free, and the degree of the compulsion must increase with the numbers massed. While consciousness, moreover, is indispensable to such movements, it does not and cannot determine the subordination of their details to the plan of the movements as a whole. That the order acquired is prepotent over any other order is not due to the consciousness or will of the troops: it is fundamentally due to the dynamic preponderance of the many over the one, of the system over the unit.

Let us now glance at the way in which dynamic memory arises with the very life process itself. Life begins in the active resistance which the nascent organic system offers, not to diminution, but to over-increase of its bulk. The first synthesis of protoplasm from inorganic matter brings not only increased complexity but also organization of the material aggregated. Under the domination of the system, configurations arise in adaptation to it and to one another. As the bulk of the whole goes on augmenting by further additions, the adaptation of the unit lags behind the structural character of the system, and this lag, in spite of slow accommodation, is a continually increasing value. The resulting tension between system and unit, the latter clinging to a structure required in the past, the former requiring a unit structure suited to the present, finally reaches a critical stage, whereupon the system divides into equal parts. By this division, which has many analogues in animal societies, the strain is relieved. But the products of the division do not remain quiescent. The hand of the past is upon them. Another tension, individual and collective, is now theirs — the tension of incompleteness. Accustomed to a larger system, and made up of units more or less definitely adapted to it, they are impelled to remake that system and to do it in a particular way. The time-and-space order of change with which they have been impressed summons them to the repetition of that order by definite and precise vicissitudes. Here is the beginning, not only of the process by which the organism produces its like, but also of that iteration of the organic cycle of change, ranging from birth to death, which we call heredity.

Now it is just this insistence of the system on a processus of events to which it has adapted itself which we see in the changes known as ontogeny — the building up of the mature plant or animal from the originating germ cell or ovum. How potently the system works as a time-and-space whole is suggested by the very numbers engaged. It has been estimated that the smallest particle of matter we can glimpse with our most powerful microscopes is about the 100-thousandth of an inch in diameter; that in this particle there are, approximately 100,000,000 atoms, and within each of them more space for the far minuter electrons — each one-millionth the diameter of a molecule — than the interior of a cathedral affords to a swarm of gnats. Multiply the particle of matter just microscopically visible to the size of a pond amoeba, and we gain some notion of what the subordination of the one to the many must mean in our bit of protoplasm. Great, moreover, as is the compulsion exerted where the simplest half-systems complete themselves after fission, it must be intensified when a specialized germ-cell is set off for reproductive ends. This comes about as an inevitable incident of the division of labor through which the organism, by differentiating itself into germ cells and body cells, makes its way to more efficient forms of self-maintenance. It is the same tension of incompleteness, the same insistence on the time-and-space order, which leads from the human ovum to the mature man or woman as enables the severed pieces of the hydra to grow into complete organisms: in both cases and in all cases, from the amoeba up to man, the reproducing part represents the system and from that system as time-and-space whole takes its power of recapitulation.

What we see, then, in heredity are changes imposed on unit and system, interadaptation of them to such changes, and therefore insistence not on structure alone, but also on an ordered procession of events through which structure must pass in being set up. For as persisting action upon the inorganic aggregate is cumulative in its effects, so with far greater preciseness and certainty do modes of motion and methods of change in the living body gain cumulative hold on the system in proportion to the length of their duration. The organism adapts itself not only to the recurring changes within it, but also to their time order, with the result that such order gets the sanction of the system and is insisted upon by it as against any other order. The objective type or plan of the organism to be thus exists in the reproductive germ as a series of paths of least stress and greatest stress towards which and away from which it must move. Growth is the recapitulation of these experiences of activity and structure which, by interadaptation of the units, the dominating system has made easiest for all of them. It represents the passing over of differential stresses into equalized stresses; it is an aspect of end-reaching, the completion of the organism being an end for each of the units and for all of them; it is therefore a means to self-maintenance. And this recapitulation results not from the distribution of specialized elements to each area of the organism to be built up, but from the coöperating dynamics of the entire system as a time-and-space whole. The "gemmules" of Darwin, the "micellae" of Nägeli, the "dominants" of Reinke, and the "pangenes" of De Vries, are no more than symbols which look forward to without reaching the real process: beneath and beyond them is the determination of the system as part and as whole to unfolding and expanding in a particular way. Death manifestly results from the complexity and interdependence which make heredity possible, and from the domination of each by all that makes insistence on the time-and-space order of change inevitable. The organism is not an object which would go on living for ever were it not attacked, harrassed and finally worn out by the unceasing onslaught of hostile conditions from without. It is a system carried through a cycle of change which, however that cycle may be lengthened, no improvement of the conditions of life will ever enable it to escape. Birth and growth, maturity, old age, death — these are stages of a time-and-space order on which the dominating system insists, and to which its interorganized units are for ever subordinated. Reproduction is therefore a provision against the inevitableness of death — a means of self-maintenance imposed by the necessity of the organic cycle. The elementary form of death is seen in simple protoplasmic fission; to this is added in the higher organisms the dissolution of the non-reproductive body cells or soma.

Out of inorganic matter protoplasmic systems must have arisen discretely, and each of them would come under the rule of the organic cycle; compelled to divide at its close, they would transmit this cycle and this culmination of it by division to their successors. In growth, simple or complex, whether of a single cell or of a congeries of cells, everything taken in as nutriment has the character of a system impelled to self-maintenance imposed upon it — acquires in turn the power to mold other material into shape for self-completion. The diminishing tendency to growth as the organism becomes more and more complete results from the gradually increasing satisfaction of the demand for increase. New material assimilated when the organism is nearly mature coöperates with the other units in requiring only the uncompleted remainder. Insistence on increased bulk, that is to say, diminishes with every augmentation of bulk, and does so because every addition of assimilated material reduces the demand for further increase. There is no molding of the system into organic character by the distribution of special " determinants " through it as so many centers of formative influence; what happens is the transmission of that character by contact, by propinquity, by the action of the inner environment formed for each unit by the total system, of the *milieu* to which each of the units must adapt itself, by direction given and received from unit to unit. And this view is not invalidated by recognition of the part which, in the higher stages of organic life, comes to be played in growth processes by the gland secretions. All the while the system is yielding of its structure for the activities of self-maintenance, and at the same time rebuilding the units which have been broken down or metamorphosed to supply energy for those activities. But the number of the units thus changed is small compared with the structure which remains, for the moment, at any rate, intact. That which is maintained is not a particular protoplasm, but a structural type. In this sense, and to this degree, the organism may be likened to a fountain whose form, rapidly as the water may flow, persists through every vicissitude; or, still more graphically, to the gradually repaired ship of classic fable which remained structurally the same though it contained no plank that had not been renewed.

The recapitulatory process by which the organism renews itself as whole and part is thus, like the nature process in general and like the organic process in particular, end-reaching, purposive. It is purposive in the sense that the renewal of the parts of a machine that have worn out is purposive. Here also the organic artificer is at work, yet the artifice is distinct from that which we know as organic evolution. The intelligent internal and relational adaptations of the organism attain to their most complex and efficient stages by a process extending over millions of years, and the working of the system towards such stages is not prescribed by any prior realization of them in some recent or remote past. Nothing is repeated: the system moves forward to something new; however guided by past advances, the artificer fashions *de toutes pièces.* In the "unfolding" we call growth, on the other hand, the period is brief and the advance wholly along lines already laid down — all required is that the intelligent adaptations which have been evolved shall reappear. And this process of self-completion is made possible by germ-plasm into the inner constitution of which have been impressed, through past association with the soma and through the delegation of function by the total system, those paths of greatest and least stress movement away from and toward which constitutes self-maintenance. It is as if the reproductive germ, at the beginning of its career, had before it a model of the organs it is to fashion and the body it is to complete — a model which exists in it as a purely dynamic urge towards a goal, representing conditions of equalized stress, which is attained only when the total organism has been built up. Organic growth and organic evolution, usually confounded together in accounts of the life process, thus differ in superficial characters. Yet both arise out of the nature of the organism as a self-maintainer: the brief process of self-completion from the germ, the activities of repair, whether of a cell or a limb, the long secular working of the organism towards the processes and organs which conserve and expand life, are all of them traceable to the system of interdependent units of which each requires all and all insist on each. The cycle of birth, maturity and death is an inevitable legacy of the process which lifts inanimate matter to the rank of life; yet, by virtue of its very impulsion to self-maintenance, the organism triumphs over the seeming menace to its continuance, even uses the succession of generations as means to new methods of adaptation and new increments of advance.

CHAPTER XXXV

HEREDITY AND PROGRESS; REMEMBERING AND FORGETTING

With heredity insisting on the past, how is progress possible? With the whole organic structure of the individual established by experiences in that past, how do modifications of the soma — characters acquired in a single lifetime — get themselves transmitted to succeeding generations? It may be well to begin the answer to these questions by considering the relations which are maintained between the soma or bulk of the body of the organism, conspicuously subject to change, and the minute germ-plasm whose function it is to give rise to new individuals. In the Weismann theory the organism does not, after each period of growth, make its reproductive germs afresh: it receives them from previous generations and passes on their tendencies, unmodified by body changes, to the germ-cells of the generations which follow. Rigidly carried out, such an arrangement would make it impossible for modifications impressed upon the body cells to take effect in the reproductive cells, and therefore impossible for characters acquired in the lifetime of the individual to be transmitted to the individuals of succeeding generations. But we can accept that interpretation of the process only by breaking with the whole character of the organism as a unified system. Nor is the conclusion evaded by positing variations in the germ-plasm which come to be conserved through " happening " to be useful for survival, since that way out is estopped by its virtual denial of any purposiveness in the organism other than that supposed to be wrought by natural selection. Says E. B. Wilson, the biologist, in "Fifty Years of Darwinism" (p. 109): "Though we may not fully understand the manner in which the germ-cells are modified, there is no inherent improbability in the conception that such modifications will produce blastogenic variations or mutations that are inherited, permanently or temporarily. We can readily understand that the constitutional effects of temperature, food, moisture and similar general agencies of the environment may manifest themselves in definite changes that reappear in following generations because the germ-cells have been directly affected in the same way as the somatic cells." That in a system the whole of whose units are interdependent as the very condition of it being alive one portion developed for the continuance of its life should be kept independent of and unmodifiable by the other portions is inconceivable. While the reproductive germ immediately determines how the body cells shall develop in ontogeny, in individual growth, it must be assumed that the total organism — acting not as something existing only in the now as an individual, but as a time-and-space whole related to all previous individuals and also to the time-life of the species — does ultimately determine what shall be required of it by the reproductive germ. This view is clearly called for by the outcome of the whole process of organic evolution as we see it before us. Assuming that there has been evolution at all, the existence of higher forms that must have arisen from lower forms is a plain fact which can have no other explanation than that characters acquired during the life-time of individuals — characters of advance in structure as well as of adaptation to environment — have been impressed upon the germ-plasm by the total arganism as a power to insist on the reappearance of such characters in succeeding generations. We may get a helpful, though distant analogy for that process by recalling the manner in which changing conditions in large communities sometimes bring new industrial processes into existence or profoundly influence modification of the old, as when an individual proprietor or firm assimilates the change and gives it effects which transform a whole society. The introduction of machines just prior to what is known as the industrial revolution might be cited as showing that it is not the single individual factor, but rather the human community, society or race, which is the real originator on such occasions. The new things come immediately from the inventor and seem sourced in him. But he is born into the total experience of his kind, — has the whole record of its experiments and achievements at his disposal, — and it is on them and with the material they furnish that he builds his contribution. Chance changes in his own mind would avail him little; he is successful because of the total yield of the social mind, experience and output, since it is that which marks out the way he is to go if he goes at all, points the path of least resistance, and impels him into it by the greater stresses which all other paths would involve. And it is this larger system of influence which, while thus showing how things may be done, also supplies the impulsion to the doing of them: as without the social inheritance for contribution and guide none of our modern inventions could arise, so without a society there would be no stimulus to their production.

What kind of variations are inherited? Confining our attention to what goes on after sex has appeared it is obvious that a distinction must be made between variations which appear only in a single individual and those occurring simultaneously in a number of organisms. There is here at work a process which may be illustrated from the manner in which we acquire what may be called general attitudes towards the environment. Our dynamic memory — the unconscious memory which conserves and carries structure along whether it be stationary or improving — preserves only the effects of common experiences arising out of general conditions. Consider the extent to which, in this sense, we have "forgotten" since our earliest ancestor, the tiniest bit of protoplasm, floated in primeval seas. Think of the experiences of all organisms since then — swimmers, crawlers, flyers, runners, walkers and thinkers. We do not inherit all of them as activity and structure because they divide into two classes — the experiences peculiar to the individual organism and the experiences which it has in common with its species as so many one-way routes which all members of it must travel. Take the example, already alluded to in another context, of our consciousness of space — the "space idea." All objects visible to us and accessible to touch, however they may vary in other peculiarities, have the extension character. Instead of inheriting consciousness of the individual objects our ancestors saw and felt we inherit the power to preceive all objects as extended. The characters in which objects differ from each other leave no impress on the organism such as it can pass on to its successors: the differences interfere with each other and do not set up any organized attitude towards them of either body or mind. On the other hand, characters which all objects have in common continually recruit each other in the effects produced, compel organization of them into structure and get themselves transmitted by inheritance. Structurally, therefore, there is a continual forgetting from generation to generation of the superficial characters of objects and experiences, a continual remembering or passing on of their fundamental or common characters. The varying ways in which organic activities may be carried on are not inherited; what is transmitted are the one-way routes of process and structure along which the organism must travel if it is to maintain itself. We do not do the particular things our ancestors did, but we do repeat the fundamental elements of what they did. The race deposit in us, being fundamental, survives all vicissitude of generations; the individual deposit, so far as it is made up of superficial elements too variable to get reinforcement, leaves no trace.

It should now be evident what kind of changes imposed on the individual organism are likely to be inherited. By "acquired characters" we cannot mean the results of haphazard modifications due to the highly special experiences of organisms not required by the general conditions of self-maintenance and unsanctioned by a species under the rule of panmixia. What are passed on by individuals to their successors are not fortuitous variations of size, shape, color and the like, but changes wrought by conditions that persist, producing experiences that are repeated, not in one individual, but in many or all the members of a species. A mutilation cannot be inherited because it occurs as a wholly abnormal and isolated experience, does not arise out of the time-and-space life of individual and species, and is against the interests of self-maintenance: if any change could follow in such a case it would be one of repair, not one of transmission. The blacksmith's highly developed arm is not passed on for the reason that all human beings are not blacksmiths — that blacksmithing is incidental and individual, not an activity needed for self-maintenance by all human beings. That which is inherited is not the speaking of English, French or German, as our parents may have spoken one or other of these languages, but the power to acquire and use language, whatever variety of speech it may happen to be.

The supposed conflict between heredity and organic ascent is a real difficulty only so long as there is failure to realize that self-maintenance means progress as well as repetition. We have been helped through the *impasse* first by taking account of all the facts which show advance actually made from inherited foundations, then by recognizing the difference between what is fundamental and what is superficial in organic variation. The whole story of ascending human civilization from its beginnings affirms the truth that conservatism is the foundation of advance, and that the most rigid prescriptions of heredity provide for progress. And within the *cadre* of that story we see ample scope for the variations by which human individuals and societies are diverted from inherited ways and means into adaptations needed to meet new conditions. As a structure, the physical organism of man has changed little since the days of the ancient Egyptians, not to take a farther retrospect; yet all sorts of social and political systems, all kinds of variation in mental outlook, have arisen among their successors. The human individual comes into the social heritage of his time subject to all the changes which that time may impose upon him, alike in the communities into which he is born and in the communities to which he may emigrate. And this scope for variation in human society is but a large-scale example of the freedom for difference and change which finds illustration throughout the realm of life. The process of organic ascent involves at every stage of it a series of departures from the foundations laid down by heredity. With increase in the store of its material the organism develops every attainable method, not only of carrying on self-maintenance, but also of increasing the scope of self-maintenance by rendering it more complex, more precise, more efficient and more economical. There is progressive division of labor, resulting in specialized tissues and organs, also along with this, by the setting up of circulatory and nervous systems, progressive unification of the organic activities, processes and structures, leading finally, under the action of differing environments, segregations and isolations, to natural species. In working out more efficient forms of maintenance the organism takes advantage of numbers and from collectivity gets resources for coöperation. There is advance of this kind when, in the simplest form of gamic reproduction, the products of two conjugating systems remain together instead of separating; it is seen on a completer scale when the group or multi-cellular organism arises and there is a gradual addition to the reproductive cells of a system of body cells or soma. Whatever explanation be given of the differentiation which brings in sex, the change is one that helps on the unification of the species and at the same time widens the basis of adaptation. Through panmixia — the intercrossing of all the individuals of a species — characters of purely local and individual origin are blended out, while fundamental characters imposed by the nature of the organism and the general conditions get reinforcement.[1] Sex differentiation and the mingling of two individual inheritances, however productive of variation, thus bring the individual under the control of the species. In other words, the area of adaptation is extended from the individual until finally it is the species which determines what adaptations shall be developed and survived. If the process were devised by a consciously intelligent artificer we should call it a means of keeping individuals true to the type, of limiting the members of the species to such variations as arise in many individuals out of the general conditions and needs of self-maintenance, of decreasing the potency of individual experiences in the interest of general experiences, of suppressing the differences which promote division and increasing the likenesses which are needed for coöperation.

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[1] It has been held that under the Mendel law there is no danger of a character once appearing in an individual being obliterated by the intercrossing of that individual with others lacking such character, the permanence of the character not being affected by intercrossing. (Bateson.) But Dr. R. Ruggles Gates ("The Mutation Factor in Evolution") maintains that the facts justify us in thinking of variation as having a freedom and plasticity to an extent which the Mendelian conception does not warrant. Davenport, an American investigator, reached the conclusion from his experiments that "very frequently, if not always, the character that has been once crossed has been affected by its opposite with which it was mated. Everywhere unit characters are changed by hybridizing." And Dr. Charles E. Walker, cited by Geddes and Thomson in "Evolution," maintains that racial characters tend to blend, and that individual characters are transmitted in an alternative or Mendelian manner."

That heredity comports with change and progress may be seen from the relation of variations to the great causal classes which include and even presuppose them. Self-maintenance requires inevitably certain kinds of activities, internal and relational, certain kinds of tissues and organs, just for the reason that, with organic matter and the environment given — all the general conditions of life taken into account, — only by such kinds of activities, tissues and organs can self-maintenance be carried on. There are thus what may be called one-way routes along which all organisms must travel in their doings and structural make-up, yet within the class character of each organ, tissue and process there is ample room for variation. Of one of these classes set up by the conditions the organs of locomotion are correlates; ether and air vibrations have their class correlates in organs of vision and hearing. All the activities of the organ, vary as they may, differ superficially from each other as they must, are bound together by the fundamental class likeness, since they arise out of iterated determinations which are also thus linked by likeness: differing movements performed in locomotion are all locomotory movements, so differing degrees of light and shade, differing varieties of color, all belong to a single class and go to the development of the organs of vision. As the total activities which an organ must perform take effect in its structure, it functions as an appliance for all such activities, with its capacity for performing them founded in the elements common to them all. Nothing shows better that the organs and appliances for self-maintenance are correlates of fundamental class determinations than the fact that they survive all special differentiations and are generically the same in all natural species.

Heredity insists rigidly on the fundamental and permanent, yet within the *cadre* of the fundamental provision is amply made for the superficial. As the organism ascends the more sensitive does it grow to likenesses and differences, the more numerous become the determinations to which it can adapt itself without breaking away from the rule of heredity. We may return here to the illustration of the fan by assuming its center to represent the fundamental characters, the outspread blades the superficial characters; for though the latter increase in breadth with distance, they unfold from the center and are under its domination. The "variation," instead of being altogether different from everything which the organism has done or been before, resembles in fundamental elements the system and its activities as they have been in the past; it therefore comes, despite its superficial difference, under the control of heredity. In this sense and to this extent the organism is always doing the same things, always inheriting the same structures. Even the activities in which life seems newest — the movement of daily change due to changing situations, to the daily manipulation of objects, to the constant interplay of organism and environment — are only variables in a complex the elements of which are bound together by fundamental likeness.

Nor is heredity put to confusion by the fact that the organism is not held to any single stage of efficiency, but so advances in structure as to reduce the expenditure and broaden the scope of maintenance. For the impulsion to maintenance is an impulsion of the living system not merely to the conservation of what it is at any given stage, but an impulsion of it to improvement, to progress, to ascent, however in particular cases advance may be estopped by conditions, even to the extent of retrogression. In the metaphorical sense life is not simply the "will to live" — it is by that very fact also the "will to power." And all such progress is advance along lines whose general characters have been laid down in the organism: here also, as in the case of adaptive variations, the superficial modifications are founded in fundamental likenesses. Changes of adaptation and ascent alike are not only permitted, but required; and whether variations which serve self-maintenance be regarded as more or less minute and continuous, as the strict Darwinians believe, or as occasionally saltatory, of the nature of "sports," as shown by De Vries, we must regard them not as fortuitous, but as teleological, and not as arising independently of the species and its conditions, but as under their joint control.

CHAPTER XXXVI

TELEOLOGY AS ECONOMY

Teleology emerges, as we have seen, from a cosmos which is engaged in activities both separative and integrating, but supremely and finally in the collocation of its material units into relatively enduring systems by way of a motion process which works automatically to eliminate conditions of differential stress and to set up conditions of equalized stress. The end to be attained is the end of maintenance, and the reaching of it brings into existence the forms and configurations we call purposive — structures and systems which seem designed, the outcome of plan. In the organism we see the simpler process expanded and complicated — expanded because of the imposed activities of self-maintenance, complicated because unlike functions require unlike appliances for carrying them on. As parts and as system the living body is also a working toward end — the end of conservation — but here, superimposed upon inorganic ways to end are the series of means to end which may be summed up as cells, tissues and organs. In the non-living realm the end is the collocations actually brought about, the equalized stresses actually set up in the systems which are maintained, which endure; end in the organism is not primarily the structure at any time aggregated, though in heredity that does become an end, — it is primarily the results reached through the working of the system and of its specialized appliances, self-maintenance being an end for each and for all of them. In this working, owing to the complexity of the organic material, enormous differences of structure are possible, so that efficiency in maintenance becomes a variable, the actual degree of it determined by the extent to which power is saved or wasted. The appliances set up are efficient in the degree that in working for maintenance they secure a maximum of result with a minimum of expenditure — achieve maintenance, that is to say, not with an ideal economy of power and of material, but with the utmost degree of it that is realizable under the conditions.

There is an adumbration of this economy in the reaching of end in the inorganic, where it has been formulated since the days of Maupertuis as "the principle of least action." "La nature," he wrote ("Oeuvres," Vol. 4, p. 12) "dans la production de ses effets, agit par les moyens les plus simples" (p. 12). "La quantité d'action nécessaire pour causer quelque changement dans la nature est la plus petite qu'il est possible" (p. 42). But what is here called "the least amount of action which is possible" has been shown by Helmholtz to be also the greatest amount of action possible, the supposed "least action" being really nothing more than compliance with the conditions which make it inevitable that when there is motion the object moving shall move away from the direction of greatest towards the direction of least stress. And these conditions do not represent any saving of power due to the selection by the object itself of a motion or course involving a least as contrasted with a greatest action. There is a possibility, nevertheless, that the economy denied to the individual object is secured by the system as suggested by Wilhelm Ostwald's definition of least action as action taking place in such a way that "existing configurations suffer the least possible disturbance." ("Outlines of Chemistry," English edition, p. 312.) The disturber in a crowd, pushed and pulled to restore him to order, may save no energy in the process which assimilates him, but the crowd economizes power by eliminating the disturbance. Inevitable also seems the conclusion that it is an economizing process by which the universe eliminates friction, substitutes endurance for change, puts harmony in the place of discord, and wrests coöperation from conflict itself. The chaos which wastes power in the realm of life must waste it in nature at large. The ordering which saves it in the activities of human beings must save it in the power system which is the source of all ordering.

But whatever part economy plays in the pre-vital realm, it appears in the end-reaching of bodies that live as of the very nature of organic teleology, and is there also not primarily of the units, but primarily of the system. In human contrivance and in nature contrivance the details may differ, the degree of elaboration may not be the same, but a single process links all the examples together: in many cases the likeness of both result and method is unmistakable. It is this which joins the unconscious fashioning of organs with the conscious making of tools, bridging the gap, as it were, between the earth-trap of the native African and the pitfall of the ant lion, between the web of the spider and the fisherman's net, the foot of the mole, the digging stick of the Australian and the spade of the navvy, the boatman's single oar and the sculling tail of the fish, the kayak of the savage and the floating pupa skin of the gnat, the scale armor of the armadillo and the soldier's cuirass, the climbing hooks of the tiger beetle and the grappling irons of naval warfare. Man economizes both power and material by the resort to hollow tubes for the handles of tools and in the construction of bicycles and the building of bridges: Nature used them millions of years earlier in the fashioning of grasses, corn stalks, innumerable plant stems, in the bamboo and in quills of feathers; the long bones of animals are little more than cylinders, which grow more solid towards the end only because special stresses of function require the thickening.

The shells of molluscs, under the combined action of the organism and its environment, take the shape which wastes power the least. The form of the limpet "gives great strength with but small expenditure of material. . . . Even where the simple, uncoiled form of the shell has been departed from, there has in innumerable instances been a retention of the general external shape, that the minimum resistance shall be offered to the waves." ("The Shell and its Function," by Edward Step, p. 33.) In his work on "Entomology" Alpheus S. Packard cites from Gräber a statement to the effect that the body of the dyticus, or swimming beetle, has been developed in a wedge-shape form so as to offer the minimum of resistance to motion. The fish long anticipated the care which naval designers take in moulding the lines of ships into least-resistance forms. Its very shape has been recognized by engineers as a practical solution of the most theoretical problems of curves and displacements in relation to submarine motion. A study of the lines of typical fishes has revealed the fact that the entering angles of many and very different fishes terminate regularly at the plane of the greatest cross-section of the body — at 36 per cent of the fish's total length. ("Fishes, Living and Fossil," by Bashford Dean, p. 5.) The skin of the fish is also developed to the end of securing conditions of least resistance: under a microscope it is seen to consist of overlapping layers of scales, with small projecting horns or points on the outer end of each scale, leading to the presumption that "the particles of water in most immediate contact with the fish are passed on from scale to scale, like the rain running off a slated roof, without pausing to adhere to any individual scale, and that their disengagement without adhesion or friction arising from molecular attraction is facilitated in some way by the projecting row of points." ("Scientific Problems of the Future," by H. Elsdale, Smithsonian Report for 1894, p. 678.)

Combined lightness and strength have been secured for the bird in a manner that, even were it the result of conscious planning, would command our unqualified admiration. The body is made large, as compared with the head, to the end of yielding a large surface for the attachment of muscles capable of raising the bird from the ground, the union of lightness with bulk being rendered possible by the distribution of air cells through the body via tubes connecting the lungs with cavities in the bones, themselves much lighter than the bones of quadrupeds. Not only is the bird's body so shaped as to offer the least resistance to the air; the mechanism of flight itself combines the minimum of weight to be lifted with the maximum of lifting power. The wing feathers possess an ideal lightness and strength not approached in these respects by any consciously contrived appliance of man; the shape of the wing is itself determined in the interests of economy, the upper surface being convex so as to minimize resistance in the upper stroke, the lower surface concave to the end of accumulating the pressure through which the bird is enabled to ascend. To this pressure the disposition of the primary feathers powerfully contributes, since, being made to overlap each other, they open out somewhat when the wing is being raised, and close up into a continuous membrane in the downward stroke.

The power-saving character of the appliances for digestion, circulation and respiration, as well as for locomotion and manipulation — for the whole complex of internal activities, as well for the adjustments to environment, sense organs included — is a commonplace of physiology, and has been amply insisted upon even in the "argument for design." Note especially that the whole mechanism of the blood circulation is disposed to the end that, by the utmost diminution of resistance, a minimum expenditure of power may be ensured in the process of diffusion. Arteries of the first, second and third class, for example, are always sub-fascial, being invested by a special enveloped of the fascia of the limb as a sheath; they usually pass along the edge of a bone for protection; kept out of the way of the muscles, they avoid the danger of compression. All over the body, moreover, certain blood vessels are given off at such angles that the blood currents encounter no frictional resistance — a provision which Wilhelm Roux sums up in the words: "The utility of the arrangement consists in the diffusion of the blood under conditions of least resistance, as well as in the carrying on of the circulation with the minimum expenditure of power and by means of the minimum of cell material." ("Gesammelte Abhandlungen über die Entwickelungsmechanik des Organismus," Vol. I, p. 101.)

One with the internal process of organ-building is the continually exerted preference in higher and lower animals for ways of reaching end alike with the minimum of effort and the maximum of result. As the growing root coils around the stone it meets, so the railway engineer usually carries his line round an obstruction, tunneling through it when its extent makes that method the direction of least stress. As the plant climbs the tree by spiral windings, so a laborer with a heavy load mounts the steep ascent by a zigzag or spiriform course; as bees construct their combs in a form that secures the utmost capacity for storage with the minimum expenditure of effort and of material, so human builders plan structural effects with a like care for saving and efficiency. The earthworm, in drawing leaves into its hole, seizes the leaf at such a point as will permit of it being pulled with the least amount of resistance; a general carrying on war, a statesman conducting affairs of government, a merchant engaged in business, all take the paths which, having regard to the whole of the conditions as realized, ensure the attainment of the ends sought with the minimum of expenditure. Nor does the passage from individual to collective activity introduce any change into the character of the process.

The earliest forms of coöperation, whether among the lower forms of life or among human beings, show the like working preference. The specialization of workmen for different branches of an industrial operation all of which might be, and were originally, carried on by each, is a familiar example of the saving of effort, material and time, and of the heightened efficiency thus secured. As repeated like actions are easier than actions which have to be continually varied, the workman economizes time by remaining continuously in one occupation; as expertness in any operation depends on the frequency with which the involved neuro-muscular adjustments are repeated, skill in handling tools is increased by continuous handling of them; as like actions become more nearly like each other the oftener they are repeated, the articles wrought by specialized sets of workmen will resemble each other more nearly than articles wrought by workmen who have to pass from one operation to another; the tools themselves are saved by being kept continuously in use.

The economy seen in the purposive character of organs and tools, of coöperative processes within the organism and in human society, is a continually increasing factor until the utmost possible saving of power, the highest realizable efficiency in end-reaching, have been attained, progress towards a maximum being the direction of least stress in each and every case. Tools, like organs, were at first of the simplest and rudest kind; yet as man grew in his acquaintance with the properties of objects — of how they act and may be acted upon — grew also in intelligence and in the number and complexity of his needs — tools of completer efficiency came into existence. From the simpler appliance of little more than individual utility sprang the machine, the tool of many parts more or less highly specialized; from ways and means that sufficed for primitive conditions emerged the social implements and processes which serve the interests of communities and nations. Hence the advance from the celt of stone, obsidian or bronze, to the circular saw; from the knife of flint to the metal planer, the pneumatic chisel, the compressed-air cutter and the rock drill; from the pebble tied to a stick to the Nasmyth hammer; from the stylus to the typewriter and the addressograph; from the wooden blocks of Gutenberg to the linotype machine; from bone needle to sewing machine; from gnomon and clepsydra to chronometer; from hand paddle to steam turbine; from flickering torch to electric light; from the rattle and drum of the savage to the modern orchestra; from the simplest methods of transit and intercommunication to automobiles, railways, telegraphs, wireless, and countless other mechanisms of local, national and international trade — all of them revealing, not only the teleology of movement and form, but also that advance in economy and efficiency — in the reaching of end and in the enlargement of its scope — which is an inseparable factor of the process out of which intelligent adaptations arise and self-maintenance is secured.

In the beginnings of human society there is little industrial coöperation: each member is his own agriculturist, hunter, fisher, — his own builder, clothier, artisan, — performs for himself, that is to say, all the tasks which individual maintenance involves. But as men discover the superior ease and efficiency of mutual aid, those tasks come more and more to be distributed among sets of individuals, specialized by and for them, with results that heighten interdependence and make for unification. Nations also, moving towards the direction of least stress, impelled towards ampler efficiency by the stresses of a less degree of it, come into helpful relations with each other, material and intellectual. And as mutual aid within the nations is a progressive saving of effort, material and time, a progressive advance in social efficiency, so on a larger scale does international coöperation work for that supreme economy of human power — the unification, not of one people alone, but of the whole planet. In the sense, moreover, that the individuals engaged do not usually look beyond the immediate results of their activities, the process is more or less unconscious and involuntary; for as the life of a great city is provisioned by each individual pursuing his own private interest as a trader, so are social systems unified without any plan devised in advance by the individuals concerned. What is therefore meant in Ratzel's assertion that "international commerce is working to convert the whole earth into a single organism of which the countries and peoples will be the more or less subordinated organs" ("Political Geography," Second English Edition, p. 22), is that social evolution is based on the life process itself, not on the deliberate choice of man, and that its end, however completely or imperfectly attained, is the setting up of such ways of acting, methods of human relation and forms of thought as shall summate the energies and intelligence of the individual in the race and bring to the aid of that individual its total power.

CHAPTER XXXVII

ECONOMY IN MENTAL OPERATIONS

The real nature of purposiveness as primarily dynamic and not primarily psychic is also disclosed by the fact that conscious processes in the organism display the same progressive economy as that shown by the physical processes which underlie them. "The tendency of consciousness to a minimum of complication," called by William James "a dominating law in psychology" (Memoirs of the Boston Society of Natural History, 1880), was applied by him to the diminishing attention we give to actions which, continually repeated, come in the end to be almost automatic. In the broader application of it the law describes the economies secured for all mental operations whatsoever by improvement of them in the individual and by perfection of them in the race. This saving is especially seen in the upbuilding and organization of language. Effort is saved at the outset by classification — the segregation of likes and unlikes into their classes: the speech label, sound or sign, enables us to sum up for use in mental operations a vast number of objects, qualities, motions, relations, which else would have to be named singly, separately and differently. What this saving means we may realize by contrasting the economy of a library of books adequately card-catalogued with the waste of effort and time which would result from the search for some needed volume in a building where unclassified books were scattered promiscuously.

Another illustration is furnished by the history of language. Its early stages show us things named more or less singly, separately and differently, with the sense of likeness poorly developed, the sense of difference highly developed. Objects and actions, though fundamentally of the same class, through differing slightly or being perceived under slightly different circumstances, got unlike names. The concrete and particular were exalted to the first importance; the abstract and general went unrecognized. In many languages we find names for particular trees, plants, animals, but no general name for tree, plant or animal. The Tasmanians have a word for each variety of the gum and wattle trees, but lack a word for tree, nor can they conceive of qualities like "hard," "soft," "warm," "cold," "long," "short," "round": in order to render such concepts sufficiently concrete for use they are obliged to add nouns, expressing "hard" by the phrase "like a stone," "round" by "like a ball," or "like the moon," and "tall" by "long legs." The Coroados have no word for "plant," "animal," "color," "tone," "sex." In many of the North and South American tongues such words as "head," "body," "hand," "foot," "eye" cannot be used save in association with a possessive pronoun denoting personal relation. The Kurd who supplied Dr. Sandwith with a vocabulary of the Zaza language had to concretize such terms as "head," "father," "hair" by adding personal pronouns, saying *sere-min,* "my head," *pie-min,* "my father," *pore-min,* "my hair." The Hoopah and Navaho vocabularies, as published by Schoolcraft, prefix a noun to all such words.

Man advanced from this effort-wasting multiplication of speech elements by advancing in the power to recognize fundamental likeness beneath superficial difference; he thus gained, with less expenditure of attention, a firmer grip on the properties and relations of things, together with a larger capacity for utilizing them in self-maintenance. Meanwhile the increasing content and growing symbolism of the word brought another economy. The name first given to an object must have indicated no more than the most prominent out of the small number of properties or qualities it was known to possess. In the case of onomatopoetic words, for example, the quality perceived and named is one of sound, and the process gives rise to such terms as *kolokol,* the Russian for "bell"; *gunguma,* the Gallas name for "drum"; *tumtum,* also a Gallas word, meaning "workman," literally "hammerer"; *krakra,* the name of a Dahoman watchman's rattle; *chacha,* the Ainu word for "to saw"; the Peruvian *ccaccaccahay,* signifying thunderstorm; the Australian *bungbungween,* used for "thunder"; *hou-hou-hou-gitcha,* the Botocudo word for "to suck"; *shiriushiriukanni,* Ainu for "rasp"; and the Quichua *chiuiuiuinichi,* expressing the noise made by the wind among the trees. Such words could not have been used other than as labels connoting more properties than those expressed, yet as knowledge grew of the thing designated, the name must have grown in its power to connote and symbolize, with corresponding reduction of effort and gain in economy. Bastian reminds us that "the Russian called the duck *utka* because he saw it plunge its beak into the water; the Pole called it *kaczka* because it noticed that it waddled in walking; the Bosnian knew it as *plovka* because he saw it swimming." Yet as now used none of these terms designate or even suggest the characters which originally gave rise to them: they signify the duck in all its characters. Thus also in our own language many terms have emerged from their original meanings — "star" from "strewn," "planet" from "wanderer," "earth" from "dry" (*terra*), "house" from "built," "father" from "nourisher," "mother" from "fashioner."

Economy is also secured by extending the application of a term on the ground of likeness or analogy. Thus Whitney ("The Life and Growth of Language," pp. 77–78) reminds us of the enlarged meaning of presbyter, originally "older person,"; volume, no longer "rolled" as when the name was given; "book," not now a block of "beach"-wood; "paper," now made of other material than papyrus; "bank," which has infinitely outgrown the simple "bench" of the money-changer in the market-place; "post," originally "put" or "placed"; and "rolling," now used in "muster roll," the "roll of the drum," "rolls of fat," even the "actor's rôle." Assimilation in all its forms, whether of sounds within a word to each other or of words less familiar to those more familiar, also involves economy. The Italians write *otto* instead of Latin *octo* — it is easier for us to say "last" than "latst" (latest) and "best" than "betst," "impossible" than "inpossible," "cubboard" than "cupboard." So sooner or later Château Vert became Shotover, and Wood's Holl changed into Wood's Hole. It is Whitney, again, who (*Ibid.*, p. 49) points out in regard to change of form that "the grand tendency underlying all the innumerable and apparently heterogeneous effects which it embraces is the disposition, or at least the readiness to give up such parts of speech as can be spared without detriment to the sense, and so to work over what is left that it shall be more manageable by its users, more agreeable to their habits and preferences. The science of language has not succeeded in bringing to light any more fundamental law than this, even any other to put alongside of it; it is the grand current setting through universal language and moving all its materials in a given direction. It is another manifestation of the same tendency which leads men to use abbreviations in writing, to take a short cut instead of going around by the usual road."

How intolerent men are of speech elements unnecessary to intelligibility is shown by the drift of the educated and uneducated alike towards a more phonetic spelling of words, by the growing tendency to use adjectives as adverbs and to break down the well-established distinction between " shall " and " will." Deeper still is the discarding of subtleties like the subjunctive and that method of relating the various words and elements of a sentence to each other which we call inflection. The enormous gain which has been secured by the elimination of this artifice may be appreciated by examining the clumsy formalism of such undeveloped languages as Zulu, in which, as translated by Dr. Bleek, the sentence " Our great kingdom appears, we love it," must be expressed as " The kingdom, our dom, which dom is the great dom, the dom appears, we love the dom." It is also suggested by the wild luxuriance in analytical distinctions revealed by all tongues in an early stage of development: note the fact mentioned by Furuhelm that the Aleutian language has a verb of more than 800 different terminations or variations in the active voice alone. Even in Greek, as Lefèvre has reminded us, the paradigm of a verb may include 1300 forms. And the process of removing these scaffoldings from the structure of language as the need for them disappears is of a piece with the homely abbreviations which we carry out in our everyday speech. Speech itself shrivels almost to a gesture when our " Pooh-pooh! " our " Take care! " or our " Look out! " more than suffice.

In reading and in listening we economize effort to the utmost. Our attention to a book or a speaker ebbs and flows according to the degree of interest we take in particular passages. We deal in reading only with the symbols that lie on the surface, being content to leave the rich content of meaning, which formal processes of attention can alone resuscitate, altogether untouched. We treat words, that is to say, as counters for the intellectual money that is at stake: this is why we know many truths without adequately realizing them, and why introspection in the intervals of " stopping to think," so expands our supposed knowledge as to make it seem like ignorance. We label our feelings as we label our thoughts, leaving the labels to do duty for the classes of things labelled. Intent only on the relational value of the symbols, we glide over the surface of our emotional experiences until, under the stimulus of some special need, the mind is enabled to plunge with illuminating effect into their deeps. The vogue of the novel in modern life would be inexplicable were it not for the fact that it helps us to dip below the emotional algebra with which we merely label life into the rich world of conscious states of which for us that life is really made up.

As in ordinary speech so in formal literary composition there is abundant scope for economy. Not only do we avoid so far as possible redundant elements; we also choose words calculated to convey our meaning with the maximum of effect and the minimum of effort on the part of all concerned, ourselves included: even what is called "laborious composition" in the reaching of the ends of composition is itself an economy. Where our end is simply that of intelligibility, as in the case of scientific statement, we choose words as simple and expressive as possible; where to the end of intelligibility must be added the end of style, we employ words more ornate and picturesque. In most prose compositions the conveyance of our meaning satisfies; in poetical writings we also seek to produce emotional states, to call the imagination into activity, to give rise to the pleasing effects of rhyme and alliteration. But whatever our ends in composition, we strive to reach them in ways that involve the utmost saving of mental effort. It is this tendency, swaying thought as well as things, which commits us to the sparing use of metaphor and parenthesis, the placing of the stronger epithets after instead of before the weaker, the avoidance of long and involved sentences, the care taken not to repeat words already used instead of their synonyms, the provision for variety which excludes monotony, the observance of a best arrangement for the words in a sentence, the massing in paragraphs of materials that belong together, and the construction of the links by which unity is secured for the whole treatment. The most perfect composition, spoken or written, in prose or in verse, always results for the ends in view in the highest realizable maximum of effect attained with the utmost possible minimum of expenditure.

Economy is writ large in the more general operations of thought. As we advance from the crude symbolism of the notched stick to the use of numbers, and from this to the employment of algebra, then finally to the labor-saving logarithm, so do we move from the simpler grouping of our perceptions as likes and unlikes into the larger classifications of thought. Cognitions widen into concepts, and concepts expand into general ideas. The sciences are economical ways of gathering and recalling human experiences of nature: they resemble card-catalogue drawers in which, behind the general class label, the facts are arranged into classes of likes and unlikes with a view to the utmost facility of accumulation and recovery, and therefore with the result of an enormous saving of effort. The philosophical interpretation of the scientific yield is another and perhaps a larger economy: in its narrower application within science it collects the facts into classes of "law" or "process"; in the wider application it condenses scientific phenomena into statements of general principle which subsume them all. The sciences show us many classes whose facts differ from each other in spite of their underlying likenesses; philosophy yields one class whose facts resemble each other notwithstanding their superficial differences. In science, that is to say, we benefit most from the economy of segregation; philosophy gives us the economy of unification.

Then there are the economies of attention founded on natural predilections and personal history. All human activities, social as well as individual, proceed by a simultaneous abstraction and concentration of mental effort —

the abstraction of attention from many things, the concentration of it upon a few or upon one. Without this saving the advantages of industrial specialization and the efficiencies of industrial coöperation would be impossible. A book to a bookseller is an article of commerce; to the bookbinder it is a technical product, to the student a treasure-house of knowledge, to the *nouveau-riche* a decoration for his library. The crowd at a football game, the inventor perfecting his machine, the biologist at his microscope, the historian among the archives, are all concentrating attention in one direction by abstracting it from all other directions. For the individual and for society, for the community and for the nation, determined by their whole make-up and history, life involves a choice of interests, a selection of values, by a process which, whether conscious or unconscious, is simultaneously one of exclusion and inclusion, and one which, simple or complex, physical or psychical, saves effort and economizes power.

In one aspect of it this economy is in the direction of ideas founded on emotional experiences and on the deliverances of sense. For the vast majority of men the saving issues in the most plausible theory of life, the most satisfying outlook upon nature, that explanation of things which involves a minimum expenditure of attention and mental effort. To men in the mass, partial aspects of reality are easier to seize than complete verities; they find " concrete facts " more comprehensible than general principles; the gently undulating slopes of belief offer them a less arduous path than that which leads over the steep cliffs of knowledge; for most of them the rosy streamers that herald morning are more beautiful than the full lights of day:

> *L'homme est de glace aux vérités —*
> *Il est de feu pour les mensonges!*

Hence it is that in his earlier thoughts about Nature man explains the invisible in terms of the visible; that he confounds the object with the garb woven for it by the subject; that he conceives anthropopathically of the things and activities of the external world; and that most of his ideas of the universe and its objects presuppose the human organism as the source of the analogies which can alone make them intelligible. The cruder symbols serve while the more refined symbols are on the way, and in the practical conduct of mundane affairs wide differences in Nature interpretation are found to be "workable." All the same, is each stage of belief, like each stage of knowledge, the most efficient and satisfying under the conditions. And the progressive rationalizations of belief, like the progressive improvements of knowledge, are at once enrichments and economies.

Mental phenomena thus show us the mind system, as it may be called, working to arrange its elements into economical, intelligent, teleological forms. They reveal in the chosen home of thought the same procession from conditions of differential stress towards conditions of equalized stress, the same setting up of likeness as a means to relation, the same perfecting of relation as means to unification, which we recognize in the world of inorganic matter and in the cosmos at large. Within the realm of conscious states we see resistance, disturbance, conflict functioning for the production of ease, harmony and order. At the heart of thought and of things is the eternal advance from wastefulness to economy, from the chaotic and fortuitous to the purposive. It is the same two-sided power which in the heavens above us works towards enduring configurations, and in the chambers of the brain beneath them flowers out into effort-saving adaptations in the interest of maintenance. In spite of all difference between the "psychical" and the "material," our conscious states follow the same law as that which is regnant in the gathering of molecules and the marshaling of suns.

CHAPTER XXXVIII

PARALLELS SOCIAL AND GENERAL

THE existence of any exact parallel between the individual organism and the so-called " social organism " cannot be asserted. In the one case there are compacted units and a rigid subordination of them to the system, in the other spatial separation of the unit individuals and at least the appearance of spontaneity in each — on the one hand consciousness and will inhering, not in the unit, but in the collectivity of units; on the other, will and consciousness possessed by each member of the system independently of the rest. Yet there is a real if limited parallel between the single organism and the group of organisms in such characters as make the human society a system of interdependent, interdetermining and coöperating individuals impelled for joint tasks towards the configurations by which maintenance may be most efficiently and economically secured. All through life, dimly shown at some of its levels, clearly marked on others, we see the individual serving its species, the species reacting more or less beneficially on the individual. This kind of service, recalling the aid given by specialized tissues to the organism as a whole, presents itself in no more than faint adumbration in the foraminifera, notably among the microgomia socialis, where members of the colony may be seen united by their branching pseudopodia. It reaches the stage of structural differentiation for mutual aid in the millepora (hydrocorallinae), some of whose members are specialized for functions of prehension, while others serve the community as organs of digestion and assimilation. A more conspicuous example is furnished by the societies of bees, termites and ants, among which "queens," "kings," "soldiers" and "workers" may be recognized as such by their anatomical peculiarities. In the higher animal societies there is no structural shaping of the organism for social tasks — only a differentiation of its functions according to the level reached. A troop of apes, according to Brehm, generally places leadership in charge of a robust and experienced male. Houssay states that antelopes, gazelles and elephants, when advancing in troops, are always conducted by an old male or female. Sentinels are employed by crows, parrakeets, prairie dogs; so bulls are known to protect a herd of cows. In man this differentiation for social function, resting on the capacity of the individual for many kinds of knowledge, training and activity, seems to leave structure altogether unspecialized. Yet if regard be had to the tools and machines in the using of which he becomes expert — all of them appliances which constitute extensions of his body while he uses them — a real parallel with the internal and relational organs of that body comes to view.

Note also the parallel of interdependence, involving the contribution of the unit to the system and the reflow of that contribution from the whole to the parts; involving also resistance to change in habitual conditions and repair when they have been disturbed. Modern facilities of transportation and communication, of trade, commerce and finance, all illustrate this interdependence accompanying differentiation, this enlarging of individual power by summation and reflow of it as community power. As separate sets of tissues coöperate interdependently in maintaining the individual organism, so separate sets of workers coöperate interdependently in securing community maintenance; as the interorganized tissues of the living body need and demand each other, so does each working group in the social body, through refluent collective power, insist on all the others as the condition of its own functioning. There is an obvious and immediate interdependence between such connected processes as coal-mining, railroad transportation and manufacturing in all its forms; there is an ultimate and none the less real interdependence between all industrial processes whatsoever. As, moreover, all are sooner or later affected by disturbance in one, so later or sooner, the power of all, community power behind it, is concerned in the elimination of the disturbance. As in the individual, so in the society, self-maintenance manifests itself as self-completion or repair: the social group, like the living body, clings to structure already set up and is active in renewing units that have been destroyed, metamorphosed or displaced. This is why workmen abstracted from industrial processes are replaced; this is why new agents and functionaries succeed to those who die or resign. A business firm which chooses a new head, a municipality that elects a new official, a constituency which calls to office a new legislator, are all interlocked, however subtly, with the community as a whole, and in exercising their own functions put forth community power.

There is even a parallel for the process of division: in the social, as in the individual system, overgrowth, like undergrowth, also serves as an incitement to the readjusting process. Molded in his activities, habits and thoughts by his community, the human individual, like the cell, tissue and organ, insists on the environment to which he has become accustomed and with which he is interorganized. All cases of " swarming " are generically alike under whatsoever circumstances the swarming may occur — are examples, that is to say, of more or less rude division, sometimes followed by regrowth. In the case of bees, when so large a number of larvae hatch out as to overcrowd the hive and interfere with the organized cooperation which is the salient character of bee life, the queen leads forth a swarm. Ant communities are known to divide in like manner and from the same cause. The beaver lodge rarely contains more than twelve individuals — its average number ranges from four to eight — so that every season, especially when a lodge or district becomes overstocked, a number of the beavers migrate. So active resistance is offered to "overstocking" in human communities. An army on the march sometimes finds it convenient to split into two or more parts. Bodies and associations of men formed for particular ends, but open to growth by continual additions to their number, undergo division when the accretions have rendered them too large to do their work or too numerous for their structural accommodations.

In that swarming of individuals from a human community known as emigration we may study, not only the act of reduction, but also the process of self-completion — not only the process of division, but also the subsequent process of regrowth — both due to the power with which the total system insists on a definite structure. Emigrants who go abroad to found a new home for themselves are known as colonists, and colonization is an act by which the products of division bring into existence a social environment like that to which they have been accustomed. The process may be compared with that shown in the earlier stages of individual reproduction, wherein any sufficiently large number of units — a twig, a branch, even a leaf — are capable of developing into a structure like that of the parent organism. It is a movement in which the emigrants seek to reproduce those characters of civilized life by which their own thoughts, habits and activities have been determined — seek, in a word, to surround themselves with the kind of human environment, the sorts of individual and social activity, which break least with their inheritance and most facilitate their tasks of self-maintenance. As the reproductive plasm begins undifferentiated where the parent plasm began, so the colonists set out as more or less unspecialized units performing all functions of maintenance indiscriminately: their social ontogeny resembles individual ontogeny in commencing with a sort of block capacity for all kinds of work. While the numbers of the colony are few, each individual will be compelled to carry on many forms of activity — will need, for example, to engage in hunting as well as in ploughing, in building houses as in cooking, in fighting as in making clothes. As the community grows there will be gradual division of the labors of maintenance, gradual specialization of individuals for particular tasks, and this differentiation will go on until the parent community, at least in its salient and fundamental characters, has been reproduced. Throughout the process particular ways of doing particular things, serial orders of change in development, activities connected with one another, are observed for the reason that, having been stored up in the memory and organized experiences of the colonists, they constitute directions of least resistance towards which the new society must move if it moves at all. Savage colonists can only reproduce a savage community; for like reasons, civilized colonists are under impulsion to bring a modern community into existence. As in the ancient world the Greek emigrant reproduced the Greek, the Roman emigrant the Roman, civilization, so in modern times, in all that relates to fundamental characters, French colonies are copies of French customs and institutions, German colonies reflect the German system, while English colonies repeat the social type and political forms of Great Britain. In colony and in parent society alike behavior seems self-sourced, and to the individuals composing them even spontaneous; yet in the deeper view, taking interdependence into account, it is seen to be also system-sourced. Throughout it is the total power of the social system, operating as a time-and-space whole, which really completes and renews, determines and differentiates, imposes adaptations, urges to economy and ensures purposiveness. And it is this power, summating individual and group potencies, which creates the appliances for locomotion and intercommunication, carries on the activities of production and interchange, organizes the means of defense and aggression, brings into existence the organs of social deliberation and will, stores up culture and makes knowledge an abiding possession.

How far, finally, do parallels between individual organism and human society hold good for the family of nations, for the race as a whole? The analogy grows less obvious the more it is expanded. As there is nothing which can be called a social organism, so there is nothing which can be described as a race organism. The interdependence of nations is much looser than that which binds their citizens together: against it are the isolations of sea and land, and the even more formidable barriers of history, tradition and language. That peoples continue to take a prevailingly absolute view of themselves, and move only slowly towards the relational view, is amply shown by what has happened since the great war. What we see, even with a league of nations in existence, is growth towards a goal rather than any immediate prospect of its realization. Yet loose as the bond may be, a degree of interdependence, of the kind which connects the human society with the individual organism, is clearly visible. It would be suggested alone by commerce and travel, and by the international functioning of such means of communication as telegraphs, cables and wireless. The reverberations of famine, plague and other national disasters go round the earth; part at least of the cost of wars must be borne by peoples that have had no direct part in waging them. In a general way, no nation is really self-sufficient; each depends on other nations for its food products, its raw materials or its manufactured articles, sometimes for all three. Nor is it merely that a reciprocal relation of supply and demand in differing degrees connects all nations, for where given countries have special facilities for producing the particular things needed by other countries there is a real differentiation of function and a structure specialized for its performance. More and more, nations doing something must take account of what other nations are doing; more and more is the welfare of each people dependent upon the welfare of all peoples. Traditions, institutions, inventions and ways of living pass from countries where they are at home to influence nations far afield. The mental acquirements of races and peoples, no less than their material products, go out to the world, and from the world to each people and race there is a reflow of knowledge and experience as stored up in minds, in books, in magazines and in newspapers.

The widest parallel of all is that which connects the organism, the society, the nation and the group of nations with the universe process itself. Material units at first "going their own way" are brought into relation with each other and compacted into systems, first for the rudest and most elementary, finally for the most advanced forms of coöperation, involving the contribution of the unit to the system and the reflow of power to the unit from the system. It is thus that the electrons, positive and negative, are brought together to constitute the atom, thus that the atoms close up into molecules, thus that material substances come forth, and thus that planets evolved or "captured" are pressed into relation with each other and with their central sun. Nor is the process stayed with the production of worlds: with them begin the most wonderful illustrations of it. Inorganic matter closes up into complex organic units; "unicellular" develops into "multicellular," and organisms dependent on and aided by their species arise. Men themselves, at first individual-istic and " going their own way," gather into coöperating groups. So clans and tribes, long narrowly self-regarding, are finally enlarged and compacted into nations, and nations move inevitably, however slowly, into the relations with each other whose ultimate goal is the unification of mankind. Delayed as it must be, reversed as it sometimes is, the whole of this upward march is a movement away from abolutism towards relativism, away from independencies towards interdependencies, away from conditions in which the activities of the units are more or less self-sourced towards conditions in which they are more or less system-sourced. This working of matter towards enduring forms — passively reached in the inorganic, actively attained by living things — looks back for its original to the primordial structure, function and activities of the self-maintaining universe. All the changes of evolution, in that aspect of it which concerns us most, are linked together by parallels, and they are thus linked for the reason that the cosmos endows its material product, so far as may be, with its own purposive process — works to fashion that product, so far as may be, in its own image.

CHAPTER XXXIX

PURPOSIVENESS OR NATURAL SELECTION?

The existence of an organic teleology at the very basis of life, individual and social, as set forth in these pages, in no wise requires us to depart from strictly physical explanations of vital processes. There is no special force in the organism unlike force as we know it in the inorganic, and no mysterious "entelechy" of subjective or psychic import to which organic purposiveness must be referred. Simple or complex, from inmost cell to periphery, the living body is under the rule of dynamics — it is a power system throughout. But this fact does not invite us to regard it as a mere web of mechanical actions and reactions, as in the view now much in vogue among physiologists. Such it becomes if we contemplate these interchanges separately as so many isolated and individual events. Regarded in their relation to the total system, the ongoings of the organism in activity and structural product are seen to be purposive. The choice between the mechanical view and the teleological view is thus the choice between the partial and the total view. Taken in favor of purposiveness it requires, not the rejection of the mechanical aspect, but only the inclusion of it within the larger synthesis. It is only the recoil from a false teleology, largely subjective, which has prevented the mechanical physiologists from recognizing the true teleology, which is dynamic. And in thus choosing they have been compelled to refer organic purposiveness to the process known as natural selection, claimed to arise out of the struggle for existence, and to result in the "survival of the fittest." Says Darwin:

> A struggle for existence follows inevitably from the high rate at which all organic beings tend to increase. Every being which during its natural lifetime produces several eggs or seeds must suffer destruction during some period of its life, and during some season or occasional year; otherwise, on the principle of geometrical increase, its numbers would quickly become so inordinately great that no country could support the product. Hence, as more individuals are produced than can possibly survive, there must in every case be a struggle for existence, either one individual with another of the same species, or with the physical conditions of life. It is the doctrine of Malthus applied with manifold force to the whole animal and vegetable kingdom; for in this case there can be no artificial increase of food and no prudential restraint from marriage. . . . Owing to this struggle variations however slight and from whatever cause proceeding, if they be in any degree profitable to the individuals of a species in their infinitely complex relations to other organized beings and to their physical conditions of life, will tend to the preservation of such individuals, and will generally be inherited by the offspring. The offspring also will thus have a better chance of surviving, for of the many individuals of any species which are periodically born but a small number can survive. . . . We have seen that man by selection can certainly produce great results, and can adapt organic beings to his own uses through the accumulation of slight but useful variations given him by the hand of Nature. But natural selection, as we shall see hereafter, is a power incessantly ready for action, and is as immeasurably superior to man's feeble efforts as the works of Nature are to those of art.

And Wallace, in describing the theory, calls the facts on which it is based "first the enormous power of increase in geometrical progression possessed by all organisms, and the inevitable struggle for existence among them; and in the second place the occurrence of much individual variation combined with the hereditary transmission of such variations. From those two great classes of facts, which are universal and indisputable," he adds, "there necessarily arises, as Darwin termed it, 'the preservation of favored races in the struggle for life,' the continuous action of which, under the ever-changing conditions both of the inorganic and organic universe, leads to the formation or development of new species."

From all this it should be plain that the theory of natural selection is a theory not of organic change merely, but also of organic ascent, and that its potency is invoked to account not simply for the external peculiarities which differentiate one species from another, but for internal adaptations as well, and therefore for the whole series of tissues and appliances, of processes and activities, which make the organism an end-reaching, a purposive system. This use of the theory, of course, compels application of it, not only to the whole movement of organic evolution, but even to the first synthesis of living protoplasm from the inorganic. What it asserts, in failing to posit any but accidental and haphazard variations — modifications due to the complexity of the conditions and the shuffling of their results — is that the organism came into being not by any process tending inevitably towards the appearance of life, but because some fortuitous aggregations of inorganic matter were nearer to having vital properties than any others, because some of the complexes set up varied accidentally in the direction of capacity for self-maintenance, because somehow and somewhen there happened to arise in them the power to assimilate nutriment, to divide and grow, to become sensitive to environment. And in this presupposition of the very capacities which natural selection is relied on to produce we reach the fundamental fallacy of the theory as applied not merely to the beginnings, but to the whole course of organic ascent, and not merely to the external differentia of species, but to all intelligent adaptations, internal as well as relational.

Natural selection was offered by Darwin as "the main, but not the exclusive means of modification." The selection he meant was of "numerous, successive, slight, favorable variations, aided in an important manner by the inherited effects of the use and disuse of parts, and in an unimportant manner — that is in relation to adaptive structures whether past or present — by the direct action of external conditions and by variations which seem to us in our ignorance to arise spontaneously." Since the theory was promulgated there have been serious misunderstandings of it, and some of them survive all attempts at rectification. But there are well-founded objections not thus invalidated which lose none of their force with the lapse of time. It may be found for one thing that the struggle for existence does not function as a factor in progress with the potency that has been attributed to it. In respect to competition between organisms, it could have little meaning at the outset of life, when organisms were few; in the course of evolution, moreover, it comes to be modified by the universal trend towards mutual help and coöperation, in many cases also by the dependence which is set up of one species upon another. And so far as the struggle against inanimate nature is concerned there is nowhere so precise an adjustment of hostile determinations as makes them just severe enough to eliminate the "unfit," but not severe enough to carry off the "fit." The reproductive waste which goes on in the realm of the lower life is plainly a provision against destructive influences to which no adaptation is possible, and in relation to which there can be neither fitness nor unfitness. Unable to arm its germs, seeds or eggs against adverse conditions, the organism is compelled to produce them in vast quantities, and the few which survive owe their survival not wholly to fitness, but largely to chance. Even after better organization and higher intelligence have come in to reduce the waste, fortuity continues to destroy fit as well as unfit: the fit now have a better chance, but chance still has a part, if not so large a part, in determining what organisms shall grow to maturity and what shall perish before attaining it. Even on the human level, where intelligence and adaptation are most perfect, the chance known as " accident " continues to eliminate fit and unfit, worthy and unworthy alike.

The power of the system to correlate its variations as they appear gets no explanation from the theory beyond an inference from it that correlation is itself a result of successful variation — that variations in the direction of correlation survive and enable the system to survive because they happen to be useful. In another respect natural selection takes upon itself a burden the carrying of which is inconceivable. What must be asserted is that every intelligent adaptation throughout the organism, from the fashioning of a blood corpuscle to the making of a fin or foot — from the synthesis of a muscle to the development of an eye, — is brought about not only by variations of localized parts, but also by simultaneous variations of like selection value throughout the system, each and all of them being selected because separately and conjointly they determine whether the organism shall survive or perish. In every case, moreover, it is essential, not only that the favorable variation which enables the system to survive shall be passed on to successors, but that further variations in the same direction must take place in them, since without such definite continuity, utterly unprovided for by the supposition of "variations in all directions," no intelligent adaptation could possibly arise. Nothing is plainer than that the changes through which the ascending organism reaches its goal constitute a definite and orderly progress towards that goal, and that for this progress no mere survival of variations which " happen " to be useful will suffice: it requires a constantly operative stress working for the production of correlated, life-favoring and therefore purposive modifications irrespective and in advance of whatever may happen to the variations after they are produced. It has been said that "how an organ could ever get started is a mystery," but it is a mystery only so long as we place the task of starting it on the theory which requires its beginnings to be of such importance as to make all the difference between life and death. Viewed as the product of an internal rather than of an external process, the early stages of an organ are seen to arise and get their intelligent adaptation character independently of their survival value.

What we are entitled to see in the theory of natural selection, as used to explain intelligent adaptations, is a naïve substitution of the results of fitness for the causes of fitness, of the results of survival for the causes of survival. Organisms vary from generation to generation; those better endowed by variation than their competitors have a better chance in the struggle for existence of continuing and leaving offspring. Why not, therefore, say that all organic progress has been achieved by that ruthless elimination of the worse chance which has given the better chance its exclusive right of way? But for variations to be useful they must be useful for maintenance and must have the organic character without which there can be no usefulness. By no effort of thought can we conceive of a purely external process of elimination giving rise to that which is left untouched by the elimination. As the artificial preservation by the breeder of two organisms whose highly special characters he wishes to intensify does not produce those characters, so Nature's destruction of organisms that are "unfit" can be no cause of the fitness which enables the organisms that remain to survive. That better machinery enables a firm in a given manufacturing industry to survive as against firms using less efficient machinery does not account for the invention of the superior machines, nor does it show that they arose as the result of accidental variations. In every case the enduring organism survives because it already possesses the favoring characters. Eager as we may be to concede that elimination of the less fit leaves the field to the more fit, the very manner in which we are compelled to state the fact is a recognition of the preëxistence of the fitness. An indefinite, non-organic variation in this sense is no more conceivable than is a chance variation from something which is non-organic to that which is organic. We might as well discuss the spontaneous variation of a bit of iron towards the spring of a chronometer or of a piece of melted porcelain towards the face-plate of a clock. A fragment of rock may be used as a missile, but it is irretrievably distant from being a hand grenade or an explosive bomb. It is said that organisms are constantly varying, yet through every variation they remain organisms. It is said that organs vary continuously from generation to generation, yet they are never anything but organs. A beak, foot or wing may show all manner of changes in size or shape, but through all vicissitudes a wing, foot or beak it remains — is always an organ, always made up of organic units correlated with each other and with the system. So vary in numerous ways — through slight differences due to material and other differences due to manufacture — the carpenter's planks, the iron rail, tools of every kind, and millions of articles which man plans and his machines fashion; yet the purposive, the means-to-end character of the fashioned object triumphs over all its accidental variations.

The most complete illustration of the closeness with which internal organs resemble consciously wrought tools and machines is furnished by man himself, as shown in Sir Arthur Keith's "The Engines of the Human Body." We read there of an organism which is "full of the most cunningly contrived inventions ever seen or dreamt of, inventions which have taken millions of years to work out and perfect." "The human machine, particularly the backbone, has been so skilfully contrived that we can walk, run or jump on the hardest and roughest roads, and yet its most delicate parts suffer neither discomfort nor damage." "A very great number of muscular engines are provided which can turn the backbone in this direction or that, just as is required to keep our bodies upright." "Instead of using a single strong engine, as in the motor cycle, the human machine has been provided with hundreds of them, placed all over the body, where they work the various levers of the limbs and trunk." "Not only have the engines of the motor cycle and of the human machine pipes of a corresponding kind, but through these pipes there passes a circulation which serves a similar purpose." "Muscular engines never become over-heated and rarely over-cooled." "It is quite clear that nature has invented a better kind of internal-combustion engine than man has yet thought of." "Muscles act as reciprocal engines." "The bones of our body are living levers." "The organism is a self-lubricating mechanism." "The heart is a double pump." "Nature provides for a just distribution of blood to the various part of the human machine." "Man has not yet conceived a design which can rival or approach the respiratory bellows (lungs)." "The body has contrivances for regulating the heat of the human machine, as well as workshops and laboratories where food is turned into fuel for the tissues." "The human body possesses a postal as well as a telegraphic system." "The organization found in the brain and spinal cord is comparable with that seen in an extensive telephone system." "The body has repair shops." "Nature has been so provident and far seeing in designing her living machines that she has provided them with a most elaborate mechanism for healing wounds and for repelling the germs which invade them." And yet all these wonderful appliances, of the very essence of artifice, purposive in character, developed because life needed to be a going concern, came into being without the least conscious direction on the part of the organisms in which they appeared. How did it happen?

There is indeed reason for believing that in a system like the organism, under impulsion to maintain itself, and subject to the law of motion which requires change to take place away from the direction of greatest stress towards the direction of least stress — under the necessity also of adapting itself to an external system which is a co-factor with the organism in determining how self-maintenance shall be achieved — even the variations of so-called accidental character which turn out to be of survival value have in them something which, were our knowledge adequate, would show them to be headed towards utility for maintenance. In advance of consciousness the organism is a forward-tending system — a system that should find variation in the direction of increased efficiency for maintenance easier than variation in no direction, and less difficult than variation in the direction of decreased efficiency for maintenance. Our own conscious knowledge of ways and means, drawn from the past, is anticipated in the organism by stored-up tendencies based on the experience of the system, and these tendencies may manifest themselves even in the variations which we ignorantly attribute to chance. But we may eliminate this possibility without affecting the result. Accept the view that accidental variations do arise in the organism: whenever occurring they can arise only as variations in a structure already purposive in its nature, and the fact that they may be suppressed or utilized reveals their subordination to the purposive rule of the system. Some of these variations promote survival, yet beneath them, as the precondition of their survival, is the organic process which correlates and incorporates them into the purposive *ensemble*. The granite rock which resists the sea's assault is fitter to survive than the soft sandstone which is worn away by every succeeding wave, but the creator of the fitness is the chemical and physical forces which loosed the one into yielding and compacted the other into endurance. Grant the freest and widest possible scope to the process which eliminates the ill-adapted and gives place and advantage to the better adapted: the fact of the adaptation defies all attempts to explain it from the results of adaptation. Where natural selection is really operative, purposive variations due to imposed function and "accidental" variations due to chance are alike subject to it. In each and every case the survival of the fittest comes after the production of the fittest.

Efforts have been made, notably by Du Prel, to unify the nature process by showing that the production of intelligent adaptations in the organic through survival of the fittest has its parallel and anticipation in the inanimate world. It is said that the inorganic is also the scene of fortuitous variations, that there also configurations unfitted to survive pass away, while those which have survival value remain. In reality the inorganic adaptations which have "intelligent character," which seem "put together with a purpose," acquire that character not because a process of natural selection gives it to them, but because the universe works to set up in them that character. There may be a conflict of tendencies among electrons, atoms and molecules, but the clash is not fortuitous in the sense that these bodies act, react and move chaotically. Possessing definite properties, they separate or come together in ways not distinguishable from those revealed in the chemist's laboratory and the far-off sun. It is not that a vast number of ways of moving and combining are open to matter, natural selection deciding which of them shall survive; it is that under domination of the total power system matter moves in the directions and towards the combinations which favor survival: hence arise all aggregations of matter, from least to greatest, from the simplest to the most complex; hence also the ordering of such aggregations into moving systems whereof the individual bodies, by adjustment to each other, as in our own solar family, take on that capacity for survival which is the character of all intelligent adaptations. The connection between inorganic and organic is not the principle of natural selection: it is the drift towards purposive forms and configurations which is common to both realms.

It is often asked how feathers could begin to form on an organism if in beginnings they were useless for ensuring survival. Much of this dilemma has arisen through failure to recognize that the use-advantage which favors the appearance of particular adaptations for self-maintenance is primarily an advantage in the saving of the energy expended in efforts at self-maintenance, not primarily an advantage in results achieved by the use of an adaptation. Take the case of a bird which begins to live or obtain its food in the water and becomes "webfooted." How does the web arise? By gradual increments, each minute variation added to that which preceded it until the structure reaches maximum proportions. But how can each of such successive stages be so useful as to "survive" as against other birds which are not thus varying? They arise not in one, but in a number of organisms out of the new conditions — water to be progressed in and the impulse to progression through it. At first progression is hard, but the difficulty operates as a differential stress impelling to movement towards conditions of least stress, and the way taken is the way to such movements of the organic molecules of the foot as results in the making of an easier job of it through the building up of a web. It is an advance from conditions of maximum difficulty towards conditions of minimum difficulty. The immediate objective inducement is not the survival-usefulness of each particular web-tending variation, but economy of the energy of the organism in one of its self-maintaining activities. The variations are of use from the beginning, but they are of use in saving effort, and their usefulness is at once an outcome of and a means to that saving. The purposive character of every organ and adaptation is an expression of its maximum-economy character as end-reaching; its growth in efficiency, and therefore in usefulness, is a progress in the degree of the economy secured. For every organic system there is always a realizable configuration of its parts, not attained at any particular stage, but attainable, towards which the differential stresses encountered in self-maintenance will impel it, with organs of maximum energy-saving character as outcome, and it is from this character that they take their " usefulness."

While, therefore, natural selection aids in the process which we call organic evolution, it can have no part in originating that advance by making it purposive. Prior to all variation, antecedent to all results of variation, is an organism which is something for itself independently of anything which may happen to it — an end-reaching system which varies, which adapts itself to environment and in purposive ways works towards survival. And this view of the process has the reinforcement of the only rational attitude we can assume towards the relation of our own consciously purposive, end-reaching activities as human beings, first to the purposive process exemplified within us, then to the purposive adaptations of the inorganic world. To suppose that there are two kinds of " intelligence " in the universe absolutely unlike each other, the one arising fortuitously, the other due to conscious purposiveness, is to imply an inconceivable as well as an unreasonable break in the principle of continuity. All likelihood and probability are against the view that when a living system is developing its internal organs it is under the régime of pure chance, but that when the same system proceeds to deal with the outer world in voluntary and conscious activities it should suddenly leave the method of fortuity and adopt that of purposiveness. Nor is it any the more likely that the way by which intelligent adaptations are set up in and by the organism should differ fundamentally from the way by which they arise in the nature which is inorganic. If we believe that so far as we have access to it this mighty frame of things has in fact both unity and continuity — is in fact a universe — then we must recognize purposiveness in life as founded upon purposiveness in nature at large, and the conscious purposiveness of man upon the preconscious purposiveness of the organism. As the cause of teleology in the cosmos can be saved only by rescuing it from fundamental implication with consciousness, so the cause of teleology in the organism can be saved only by emancipating it from fundamental implication with the process which secures or promotes the "survival of the fittest."

In this brief sketch of the simplest meanings of life, with numerous secondary aspects of organic evolution untouched, with many amplifications and qualifications omitted, the aim has been to show that intelligence is primordially dynamic in the organism as in the universe, and that all forms of it, organic and inorganic, instinctive and voluntary, are as to their modes and source fundamentally one. In place of vague assertions that processes within the living body reveal the tendency which Von Baer called *Zielstrebigkeit*, or are mysteriously presided over, according to Hans Driesch, by a "psychoid" which directs without exerting any causal action, we have the account of an intelligible process due, not to a special vital or psychic force, but to organic causation — to the impulsion exerted by the living system as a whole over its own parts, and to the nature of motion as a procession away from conditions of differential stress towards conditions of equalized stress. We also see the so-called perfecting tendency rationalized by reduction of it to dynamic factors. Not only are the organic units urged into efficient and economical configurations by the resistances they meet with in functioning: the entire organism, by its very nature, is under a differential stress impelling it as whole and part to higher and more perfect means of self-maintenance, the direction of least stress being the direction which leads to completer division of labor, greater specialization of function, improved forms of reproduction, closer coöperation between the members of the species, more complete relations with and finer adjustments to environment. Where, therefore, the nutritive and general conditions are favorable, the organism ascends in the scale of life, handing down to its offspring such progressive variations as obtain the sanction and support of the species.

The organism must thus be conceived of not only as working to maintain itself, but also as working to expand its powers and opportunities as a self-maintainer. It has a set towards everything useful for life, and every advantage seized does but intensify that primordial determination. With a past which it must respect and a present with which it must struggle, it also has a future towards which it must unceasingly strive. As it is easier to complete a circle partly traced than to convert it into a square, easier to finish a domicile half built than to turn it into a lighthouse, easier to round out a power loom half constructed than to remake it into a dynamo, so is it easier for an organism which has been determined into a particular direction to follow that out to its full development than to turn aside into other paths. As the ends towards which men work in the present are pre-implied in all previous human evolution, so the future is dynamically present in each organic system as so many foreshadowed stages in which, under favoring conditions, the incipient stages are to find their goal. In man this goal is illuminated more or less by consciousness: it is dark, but none the less potent, within the organic system.

We must therefore assume that if adaptations in the inorganic do not arise capriciously, there can be no ultimate fortuity in plant and animal. If in spite of countercurrents there is a vast cosmic drift towards economical, efficient, enduring intelligent forms, the living body cannot be helplessly subjected to the unrule of chance. The variations out of which such forms arise in the organism, whether minute or "kaleidoscopic," acquire their intelligent character not fortuitously, but through movement towards definite goals prefigured by the needs of self-maintenance, the character of matter and the nature of the motion process. And though natural selection may powerfully help to conserve what has been won, the winner of the advantage is always the organism itself.

CHAPTER XL

THE LADDER OF LIFE

It may here be well to look back over the events, inorganic and organic, which culminated in man, with attention given only to well-defined stages of the ascending movement, and without emphasis either on its discontinuities or its failures. For such a survey we must revert to the period when the cosmos gave forth that differentiation of itself which we call matter. The ether is to be assumed at the beginning of things, for without it the process called evolution loses all intelligibility. Eliminate the ether from our thought and we should have to envisage the universe as a mere containing vacuum for things, to regard material units as unoriginated and existing in their own right, to view them as at once unlinked by any connecting system and yet as endowed with mysterious powers of acting on and influencing each other through "empty space." The common characters which matter everywhere displays, from the reaction in a chemist's laboratory to the clashes which go on in the most distant stars, would alone entitle us to regard electrons, atoms and molecules as belonging to and emerging from and depending on an all-inclusive system of power. A degree of symbolism is inevitable in any account of material ultimates, and the physical descriptions we get of them must submit to that limitation. But to regard the atom, with Sir Ernest Rutherford, as "a massive charged nucleus or core of very small dimensions surrounded by a cluster of electrons probably in rapid motion" does not prevent us from treating it as a unit buttressed by a system. To say that matter is electricity, positive and negative, does not make it any the less an entity or divest it of its character as power: a material ultimate called by any other name would remain an individual and move just as swiftly.

With the vacuum hypothesis eliminated, we may assume a process by which the ether gave forth from itself the makings of things. Produced over vast areas of the universe, matter in its earliest and most nebulous form — such diffused and inchoate matter as we see in the Trifid nebula of Orion — was gradually compacted into glowing suns, and these probably served as the mighty forges in which were wrought out the atomic and molecular combinations that form the basis of the more than ninety substances now known to chemists. How the planets were evolved, whether according to the Laplacean, the planetesimal or the " capture " theory, need not be discussed here. But whatever the process, and through whatever vicissitudes incident to earth-building, our planet came out of them with seas, lands and atmosphere ready to support a new collocation of the elements and a new type of activity. It must be premised that life did not arise as a mere result of increased complexity, but because, as a result of that complexity, and of the mobility which went with it, a relation of interdependence was set up between parts and whole such as made the protoplasmic aggregate a self-maintaining system. We have already seen how, as a result of overgrowth, the division of that system came about, setting up the cycle of birth, growth, and death. In due course there would follow the advance from protozoa to metazoa, from single-cell systems to systems multicellular, making possible the differentiation of the units into special kinds of tissue for special kinds of internal and relational work.

Involved in this advance and necessary to it was the differentiation of the organism into germ-plasm and soma

— a division of labor by which a portion of the system was set off for reproduction and the rest of it, far greater in bulk, specialized, on the one hand for internal activities, on the other for commerce with environment. The union of cells for reproductive ends appeared early in the life process: beginning probably as a form of nutrition, it went on evolving through hermaphroditism — the production of unlike reproduction elements by the same organism — until the changes which constitute sex were set up, with result in dividing between two individuals a function which had originally been exercised by one. Sex laid the foundation of family life; it also helped to unify the species, to keep its members likes to each other and thus to promote coöperation between them. But primitive modes of reproduction involved enormous waste: against them fortuity arrayed itself on a tremendous scale. Millions of germs were lost in an environment to whose hostile forces there could at first be no adaptation. It was as if the organism found itself compelled to reproduce thus lavishly in order that, after all destruction had done its work, at least a few of the seeds should survive. And life took the way out from this waste by providing its germs with devices which greatly increased their chances of coming to maturity. In animals a further advance is seen in the protection of the reproductive material by a shell the contents of which were hatched out by the sitting mother; a still more efficient method of caring for the germ was that by which it was retained within the body, to be matured there. The development of mammae in the mammalia enabled the mother to feed her young in the period immediately following birth.

Along with this resort to adaptation as a means of reducing expenditures for reproduction had gone a continuous reaching out for resources that would favor life and expand its scope. The organism was engaged from the beginning in what Prof. Henry Fairfield Osborn has called "the capture of energy." There was "an early grouping of oxygen, nitrogen, hydrogen and carbon such as we witness in the lowest stages of bacterial life. Hydrogen and oxygen, elements unrivaled in chemical activity, functioned as 'attractive' agents to enable the life organism to draw in other chemical elements to serve new purposes and functions" — elements, it is suggested, such as potassium, sodium, calcium, magnesium, iron, manganese and copper. And after an immense period of geologic time the addition of magnesium and iron to certain hydrocarbons made it possible for the plant to develop chlorophyll for the utilization of the energy of sunlight in the extraction of carbon from the atmosphere. "When absorbed by chlorophyll," writes H. Wager, "the energy of the light waves becomes transformed into the energy of electrified particles, and this initiates a whole train of chemical reactions, resulting in the building up of the complex organic molecules which are the ultimate products of the plant's activity." Rooted in the soil, and gathering its materials from the inorganic, vegetable life supplied the nutriment from which animals ultimately drew their sustenance. And the animals also captured energy as they captured food. Oxygen, present in both air and water, would have destroyed them, as it slowly or swiftly disintegrates inorganic objects: they utilized it as a source of energy, developing to that end first the gills in fishes, later the lungs of land animals.

For all the higher physical activities, especially for progression through space in definite directions, the organism needed a rigid bony framework for the support of its fleshy tissues. Animals which failed to acquire this support remained on the lower levels of life. The vertebrates, originating in the seas, swam out to possess the land and passed on their spine and bony structure to the amphibians; from the amphibians came terrestrial vertebrates of reptilian form, and finally from some offshoot of these the near mammalian ancestors of man himself. All the while the organism had been developing its means of acquaintance with environment. The sessile plant could wait, as it were, for influences to reach it from the surrounding; the moving animal had to distinguish between things and "empty" space, to be aware of the sizes and distances of objects, to adjust its attitude towards objects useful or indifferent, friendly or hostile; and out of this necessity came sense organs, each an adaptation to some special class of incident forces. Feeling was first a sense of contact with objects. When the organism began to receive nutriment at a particular part of its body the sense of taste was developed. Particles diffused in air were utilized for the sense of smell, atmospheric vibrations for the sense of hearing. But of vastly greater importance for the upward march of the organism was that it should turn to advantage the light vibrations which, originating in the sun, were reflected during daytime from all objects in the environment. The development of vision worked a sort of miracle: first providing simple sense equivalents for outer realities, the organism finally projected outward, as it were, light impressions received at the surface of the body, and did this by converting the subtile interchanges between objects, eye lens, retina and brain into the definite picture of an external world. Vision greatly increased the efficacy of commerce with environment; it also brought a physiological division of the twenty-four hours into day and night. The plant, doing business with the sun, had its period of inactivity after light and warmth were gone. For the seeing animal vision divided the time into hours of waking and slumber: it was not that weariness due to prolonged activity made sleep necessary, but rather that the deliverance of the organism from the need of movement during a period of darkness and danger, by producing a habit of restfulness, led to the economies of slumber and organized it into the very fabric of the bodily processes.

But the larger command of Nature, not secured by organs of locomotion and sense, had yet to come. The plant, by solving the problem of how to assimilate the inorganic elements, provided the animal with its means of subsistence; by clothing the land with vegetation it supplied the means whereby the quadruped was to be lifted from its bondage to earth and enabled to stand erect. Forests not greatly unlike those we now preserve for ornamentation, use as firewood or turn into paper, wrought this epoch-making change in animal habit. From the climbing activity came gradually the development of hands where only feet had been. In the quadruped the mouth had served as an organ of prehension, as the only "hand" it possessed for exploring the surrounding, for the seizure of objects, and for such rude manipulation of them as might be needed. With the coming of the upright attitude this function of the mouth passed to the hands, releasing these from tasks of progression into tasks of grasping, holding, carrying and wielding. The muzzle and teeth receded; the skull became larger and the brain grew; the head could be turned more freely from side to side; through eyes facing to the front there came a wider and steadier outlook into environment, a keener consciousness of objects and their properties, of how they might be avoided or attained, how manipulated and utilized. A new stage was meanwhile entered upon in the care of offspring. The young of the lower animal had been left to suck at will; the mother now took her offspring in arms to nourish it. Instead, therefore, of needing to be born fully equipped for the activities of life, it experienced what has been called "the prolongation of infancy." A well-known theory posits this as a means to the development of faculties, tendencies and habits that could not be supplied at birth. For as organic evolution proceeds, as close family associations are set up and group association begins, the individual more and more needs in the after-birth period what may be called the group or social contribution. But it was not that "infant helplessness," produced with a view to this contribution, impelled the mother to greater care of her offspring; it was rather that care which released it from the necessity of immediately caring for itself, held its faculties for a time in abeyance and gave it the advantage of nurture and training.

The closer relations thus set up between parent and offspring were the beginning of the higher forms of family life. Out of the erect attitude and the development of hands came new stages in the evolution of mind and closer coöperation between members of the group. The higher kinds of coöperation led in turn to that means of mutual intelligibility and agreement which we call speech. From what commencements the first sound language had its rise is largely a matter of conjecture. Its incipiencies have been traced to gestures, to emotional cries and to the imitation of sounds proceeding from objects animate or inanimate, with the probabilities in favor of a diverse rather than a single origin. What we may take for granted is that particular sounds uttered were gradually associated with particular objects, actions and experiences; that the association was observed and utilized for intercourse by all the members of the group; that by a long course of development the earliest generalized expressions were gradually differentiated into expressions more precise; and that finally, by a progressive analyzing out of meanings, relations and times, resting on concrete names for things and actions, an intelligible system of speech forms came into use. Spoken language wove a new bond for the family, greatly increased group coöperation and multiplied by a larger factor the aid which the individual received from the community for defense, for aggression and for the multifarious activities of maintenance. It was the culminating achievement of a process which had given the organism its brain and nervous system, with stimulating and inhibitory command over the internal activities, with power to attend to impressions from without and turn the flashlight of self-consciousness at will upon the stored-up experiences within. It quickened voluntary choice, rendered thought more precise and deliberate, and enabled the user, in a degree never before possible, to draw guidance from the past for his action in the future. There were later acquisitions, such as learning how to produce fire and discovery of the art of agriculture. But our subhuman progenitors had already reached the status of men when the new bond of intelligible speech had established itself between them.

Such in brief were the main stages of organic evolution. The merest suggestion of the process suffices to show how impossible it is to reach their meaning by mere description. Without some key to that meaning it is an unsatisfactory exercise of the imagination, informing as we may find it, revel in it as we may, to look back hundreds of millions of years to the beginnings of the earth and trace the gradual precipitation of its material into land and sea and air; to dip into periods archaeozoic, proterozoic, mezozoic and cenozoic, taking note of times Cambrian, Ordovician, Silurian, Devonian, Permian, Triassic, Cretaceous, Tertiary and Quaternary; to range fossils side by side in textbooks or in museums that the upward trend of life may be visualized; to revive Pithecanthropus, reconstruct the semblance of a human form from the Neanderthal skull and place " the Piltdown man " in his proper chronological perspective; then to follow the " cultures " up through the Chellean, the Acheulean, the Mousterean and Aurignacian to the neolithic and finally make our way out through the period of bronze into that of iron. The studies antedating life help us just as little, even when inspired by the assumption that matter contains the promise and potency of all the forms of life: analyzed to their depths, the bare physico-chemical and electric properties of the inorganic elements fail to yield the needed explanation. It is just as vain to look for it to the "struggle for existence" without prior elucidation of the existence which struggles, to the "survival of the fittest" without showing of how the fitness originates, to the causes which lead to the formation of species without accounting for the individual life from which species emerge. Nor can consciousness be invoked to explain that which is below and earlier than consciousness. The problem of the why and how of it all will not down, and the only solution in sight is that which, reading the basic meaning of intelligence into the very nature and modes of power, envisages the organism as a self-maintaining, end-reaching and therefore purposive system.

What finally may be the outcome of these evolutionary modes and ways, so inconceivably vast as to time, so unutterably wonderful as to origin and import? That they will reach out far into the future until many of the ambitions of the scientist and the inventor have been realized is not an improbability. That they are to continue into an age when individual greed will have lost its power to promote social discord and the road to world peace shall no longer be blocked by the selfishness of nation or of race, is surely a reasonable expectation. That they will go on indefinitely is not thinkable, for the ultimate cooling of the sun, the final close of the earth's life-period, may be looked forward to with certainty. But a more radical "end of things created" is conceivable, and we have it prefigured for us in the untutored thought of the race. The Scandinavian peoples believed in the "Ragnarok" or "Twilight of the Gods." They pictured a time when the divinities of Valhalla and Niflheim, the inhabitants of Joetunheim, Elfheim and Midgard, together with their dwellings, would be destroyed. In the clash which their story portrays Odin himself, "the broad sky" or "bright heaven," wedded to earth, is one of the slain. Then Surter darts fire and flames over the world and the universe is consumed. The sun grows dim, the earth sinks into the ocean, the stars fall from the sky, and time is no more. But the Scandinavians did not originate the theme. It had been an obsession and a foreboding of the human mind from the beginnings of speculation. It weighed upon Egypt and was the burden of the Greeks. Rome had already taken it up when the poet Lucretius asked how long "the walls of the world" — *mœnia mundi* — would continue to resist the onslaughts of motion. From the Tiber it came down into modern times for new forms of expression. Even Shakespeare's rich nature realm was to fade like "an unsubstantial pageant," leaving "not a wrack behind." And Heine dreamed of a day when the fields would be rolled up like carpets and a verger would mount a tall ladder and take down the sun.

The hard-won knowledge of centuries is often anticipated in the myth, the poetic fancy and the religious belief. There are scientists who forecast the final conversion of all matter into its primitive elements; there are physicists who predict that, even as the bubble returns to its ocean, so will material things be finally submerged in the ether that gave them birth. For matter is perishable. One material substance, radium, is known to be undergoing disintegration — throwing off particles of itself with a velocity nearly equal to that of light, and there is reason to believe that all substances are thus breaking up, slow as the process may be. "The fatal quality of atomic dissociation," wrote Sir William Crookes, "appears to be universal, and operates whenever we brush a piece of glass with silk; it works in the sunshine and the rain drops, and in the lightnings and the flame; it prevails in the waterfall and the stormy sea. And, although the whole range of human experience is all too short to afford a parallax whereby the date of the extinction of matter can be calculated, protyle, the 'formless mist,' may once again reign supreme, and the hour hand of eternity will have completed one revolution."

An even deeper meaning may be read into the Scandinavian myth. As it is probable that the inorganic elements are constantly being lifted from the lifeless to the animate condition, so it is conceivable that matter is continually arising from the ether. Such a process, involving the conversion of constitutive energy into kinetic energy — power in the primordial into power in the secondary form, — may result in a strain from which the ether might be relieved by recovering matter into itself. Does that recovery take place slowly and in different parts of the universe, or does it occur instantaneously in all cosmic areas, like the reaction following the sudden release of a coiled spring? If the latter supposition be entertained the "last day" will be reached without warning and dramatically, with nature at her busiest, in the moment when the whole fabric of material things returns to the ether. And the speculation which pictures that return provides also for alternations of the process, envisaging the universe as aroused again from quiescence, traversing once more its period of evolution, then falling back into inactivity, but only to begin its creative work anew — committed by its nature to an endless succession of cycles, each remotely anticipating the organic cycle itself, which has been said to close for man

> When that which drew from out the boundless deep
> Turns again home.

PART IV

PURPOSIVENESS IN MIND

CHAPTER XLI

WHAT IS CONSCIOUSNESS?

If we have won anything from long questioning of ourselves and nature, it is that our conscious states need both a world and an organism for their explanation, and that physical interrelations between living and not-living are the precondition of feeling in all its forms. Prior to consciousness are the action and reaction which converse with environment involves; out of motion through, contact with, and manipulations of objects comes the observed correspondence between psychical states and physical adjustments. We are correct in our general estimates of the properties, sizes and distances of things not because consciousness of these facts has been given to us ready-made, to be imposed on things, but because our psychic states have adjusted themselves to our experiences as movers through and manipulators of it. And though our acts of knowing as such must be subjective, we are increasingly careful to distinguish between them and the things known. In inorganic objects at least we hasten as investigators to recognize power, and power alone. Had science reckoned on meeting purpose, will, choice, caprice at every turn, it would have made no progress. All advance in the knowledge of nature has been achieved by the elimination from it of everything resembling what we know as voluntary effort and conscious action in ourselves. All human mastery of nature has been secured, not through the supposition of a play of consciousness upon things, but through the recognition of interaction between things:

Leicht bei einander wohnen die Gedanken,
Doch hart im Raume stossen sich die Sachen.

And yet we always have with us the notion that somehow or other the teleology of the organism needs psychic action at its very *raison d'être;* that life could not be carried on were not the organic units to some extent conscious of what they are doing; that end-reaching, in part as in whole, must be traced to elementary endowments of awareness and will — that in a word power requires the supplement of a psychic principle before it can develop, either in inorganic or organic, what we know as intelligent adaptations. In this way the subjectivist regards consciousness as inseparable from intelligence, and especially insists on the need of it for vital processes. "It is just because," writes William McDougall ("Body and Mind," 1911, p. 354), "we have found that mental and vital processes cannot be completely described in terms of mechanism that we are compelled to believe in the coöperation of some non-mechanical factor, and to adopt the hypothesis of the soul." But how any "factor" can "coöperate" without being force-exerting and therefore mechanical is not shown. As holders of the view that intelligence is *au fond* dynamic, we need therefore to realize how it happens that consciousness comes to be associated with organic self-maintenance, what the relations are between them, and to what degree, if at all, the so-called "psychical activities" are essential to bodily activities — in what sense, that is to say, consciousness is ancillary to life.

Several attitudes towards the psychic principle are here subsumed. The hypothesis of a soul pervading the body, residing in and separable from it, need not be discussed: all that it does is to symbolize organic powers which it cannot otherwise explain, and to leave us with the independent mystery of the psyche on our hands. The doctrine of psychophysical parallelism, alleging mere concomitance — a psychical change for every physical change, with no possibility of interaction between them — is a further incursion into the realm of the mysterious: by universalizing what is only a superficial, not a fundamental character of the organism, it plainly denies the conditions which limit awareness, feeling, consciousness, to living matter, and to that alone. In the one hypothesis we envisage a world of souls set over against matter, with unintelligible powers of invading, directing and wielding it; in the other we confront an absolute dualism of psychic and dynamic with any sort of relation between them, save that of concurrence, flatly and naïvely denied. Alternative to both, and rightly restricting the problem of consciousness to the realm of life, comes epiphenomenalism with the claim that, while psychical change within the organism is produced by physical change, there is no reciprocal production of physical change by psychical change — that consciousness, in fact, is related to molecular movements in brain and nervous system only as the shadow is related to the moving wheel that casts it, or as the noise made by a machine is related to its mechanisms in operation.

This latter hypothesis, which offers no account either of the nature of the "epiphenomenon" or of its connection with the phenomenon, has been held to imply that "the actions, words and gestures of every individual of the human race would have been exactly what they have been in the absence of mind," that "had mind been wanting the same empires would have risen and fallen, the same battles would have been fought and won, the same literature, the same masterpieces of painting and music would have been produced, the same religious rites would have been performed, and the same indications of friendship given." Yet it is possible to reject this method of refuting the by-product hypothesis without accepting the hypothesis itself. For if consciousness be only an inactive concomitant of the activities described, it is so inevitable a concomitant, however arising, that to imagine it away would be to imagine the physiological processes away, and therefore the organism away. How could we believe in the continuing action of a bell or steam-whistle if no sound were given out, and why not ask whether such action could be exactly the same if it were unaccompanied by the air vibrations which necessarily and always accompany it? Would the molecular activities within the incandescent fibre of an electric lamp go on just the same if it did not glow? The issue as regards the human organism is not whether it could function without consciousness and mind — it is how in that organism certain physiological processes come to be inseparably associated with conscious processes. And here some plain facts warn us away from the assumption that activities of high importance for the carrying on of life must — solely by virtue of that importance — be performed consciously, if at all. The whole of organic evolution, from its earliest beginnings on this planet, has been throughout an unconscious process. For many millions of years the ascending organism has solved its own basic problems without help from mind. No plant ever progressed by conscious effort from incipient seed to stem and flower; no animal or succession of animals ever consciously contrived the organs and internal processes which, through aeons of commerce with and adaptation to environment, finally reached their highest levels of complexity and efficiency in man. In all organisms the wonderful repetitions of heredity are secured without conscious effort on the part of the body renewed; within the organism from birth to death, in all stages of its advance from lower to higher, go on marvellously intricate processes unnoticed by the senses, removed from the control of will, and beyond the power of mind either to initiate or to direct. This does not show that the activities we now have to perform consciously could be performed without consciousness: it does show that consciousness, however originating and whatever its nature, is not the driving power of intelligent, purposive adaptations.

Now the illumination which we have as conscious is an irreducible fact, set off by its unique character from all other facts. It can never coincide either with our idea of the things it means for us, or with our idea of the internal process out of which it arises. But with the nature of the organism in our minds we may gain some insight into the conditions under which consciousness comes to be superadded to its merely physical processes, as a preliminary to realizing how it is related to them. Beginning with the simplest protoplasmic system, as yet far off for human observation from any traces of organization, let us consider what must result from motility. Such a system of interdependent units is subject as whole and as parts to the shock of all the changes imposed upon it by environment and arising within it as reaction against environment. It is not merely that the disturbance is diffused: it calls forth a reflex movement of all the units, and it is this reciprocal tremor of all of them jointly implicated and reacting which constitutes the objective side of whatever awareness or feeling the incipient organism is thus far capable. The earliest motile life-form will thus experience the incipient manifestations of consciousness as the concomitant of its activities. But as, with advancing organization, uniformities of outgoing action come to be set up, uniformities of influence from without provided for, feeling will be more and more withdrawn from established orders of change, and restricted to variations from such orders. For motions that recur with constancy, for processes that go on with unbroken regularity, there is no shock, and no reaction of the system. Consciousness remains only for those muscular and mental activities which, falling outside routine, evading organization, cannot become automatic. And even for these, with the gradual splitting up of function and the division of work, it comes finally to be located in the brain.

Consciousness is thus of the sudden, the irregular, the unaccustomed. How do the organic activities undergo division into usual and unusual? Here the conception of group actions and reactions will aid us. Each specialized tissue, the physiological process, the organ, has the character of a class, since each arises out of a special set of class determinations: it is because the properties of matter exist in classes, and because the incident forces exist in classes, that the organism must react on them for self-maintenance by means of processes and organs that constitute classes. Gravitation is an objective class, and has its organic correlate in appliances for locomotion; ether vibrations and air vibrations form classes and have their complements in organs of vision and hearing. Out of the incoming of continually repeated determinations that are likes to each other, requiring continually iterated outgoing actions of fundamentally like kind, arises each of the organs by which self-maintenance is secured. Thus the coiling tendril of the plant matches the stem to which it clings, as the prehensile foot of the bird matches the branch which has helped to mold it; the tree bark bodies forth its resistances in the woodpecker's beak; in the water world which they incessantly beat the fin and tail shape themselves; from the enclasping fields of air through which it must struggle the wing arises. But while organic class is thus the correlate of objective class, there are degrees of resemblance in the conditions of action, incoming and outgoing. In the lower life the correspondence between organization and activities is close: this is the realm of motions requiring little or no choice, of mechanical response, of reflex action, of the so-called tropisms, and to a greater or less extent of instinct. As complexity increases, as the impulsion to self-maintenance demands more precise and varied adjustments to environment, as motion and manipulation grow more selective and discriminating, the organism analyzes out the original likeness of conditions into differences, with the result that the organic class comes to be split into actions which can be automatically performed, and other actions which must be voluntarily performed. The change occurs not in the physiological processes, which are relatively constant, but in the muscular and mental activities which relate the organism to its surroundings. Some of these are not accompanied by consciousness for the reason that the determining elements are likes to each other; others must be consciously performed for the reason that, though belonging fundamentally to the class, the elements differ superficially from the class, and thus need effort to include them within it.

This breaking up of the original holophrasm of the class may be illustrated from the sense perceptions. In vision, for example, there can be at first only the vaguest sense of light and shade; in the latest stages we find these analyzed out into multifarious varieties by the class organ, the shade definitized as objects, the light broken up into colors. So sound, at first a generalized sensation, comes at last to be broken up into differences, with a specialized appliance in the ear for recognizing each. Now all the varieties thus arising belong fundamentally to their own class — that of light or sound — and are therefore dealt with by their class organ. But as varieties they need to be won, as it were, from their superficial difference into coalescence with their group. Thus for the relational adjustments of itself to environment, and for the mental processes it must carry on, the organism is always doing something new within the class — something which belongs fundamentally to the class, but varies superficially from it, and is therefore never exactly like what has been done, perceived or felt before. For the higher organisms, to be alive means to be ever moving, manipulating, mentally active — means to be involved in constant changes of relation to environment through a complex of experiences in which no two muscular movements, no two mental adjustments, no two cognitions of objects, or even of the same object, can be exactly alike. The brain is thus continually meeting situations which, though fundamentally old, are superficially new; the whole of organic ascent is in fact a progressive analysis of reality into those variations from the class which demand effort and choice for their inclusion within the class. It is for these variants from an original theme, this doing and this perceiving of things superficially new yet fundamentally old, that the organized brain mechanisms do not suffice: for them special connections have to be made between the neurons, fresh paths furrowed for the flow of nervous energy. And in this deviation from the customary, from the usual, from the organized, the whole brain engaged in the effort quivers in response, and there is not only the deed, but also the illumination of it.

With consciousness thus arising, it is impossible either to lift it to independent rule over the bodily processes, or to trace to it the characters which constitute their intelligence. If consciousness were needed to keep one set of organic activities intelligent, it would be required for the intelligence of the other set. When processes of such vast importance for life as those within us can be maintained without direct aid from consciousness, it is idle to claim our feeling of narrowly localized psychical changes within us as the driving power of the unconscious process on which their very possibility depends. Nothing more completely routs that claim than the spectacle of the wonderful architectonics by which, dynamically guided, the germ-cell of each generation builds itself up to maturity anew. That which is fundamental in our psychic states is not what we feel them as, but what they mean for us. And their meaning for us is bound up with our activities as self-maintainers. As all unity of the conscious life is buttressed in the unity of the bodily life, so all grades of feeling, organized and unorganized, point to their source in physical states. It is not mental modes, existing primordially in their own right, which impose themselves upon physical modes, but physical modes which give their character to mental modes. As our knowledge of Nature and of living things dips below organized conscious states into the objective world which they signify, so in those states do we look down into the realm of inner physical change which is their real meaning for self-maintenance. Nor is it otherwise in pain and pleasure, the psychical symbols for things life-favoring and life-injuring. Nothing absolutely for themselves as feelings, they are plainly the correlates of physical states deeply associated with the interests of life. If we have any conviction about them, it is not that we impose them upon the body, but that the body imposes them upon us. From the threatened negation of maintenance comes the shock we call pain, from the new affirmation of maintenance the shock we call pleasure; and each is founded in a purely physical attitude of the organism towards its own experiences, imposed or self-originated. In lure as in dissuasive, we are aware of the situation, but it is the body which acts. And in some situations, where pain has to be avoided, the action is so sudden as to put its dependence on consciousness altogether out of the question.

What, then, shall be said of mind and of its presumed action on body? Before answer can be given, the traditional conceptions of body and mind must be revised: as still currently used, they are misconceptions. Setting out from the belief that mind and body mean fundamentally different things, we confine ourselves to assertions or denials of interaction between them. In the one hypothesis the assumption that there is no mind in body gives easy success to those who assert that intelligence is explicable only as the outcome of mind; in the other, the assumption that there is no body in mind yields just as easy a triumph to those who claim that intelligence can be explained from the physico-chemical properties of organic matter alone. What both lack is an adequate grasp of the resources of the organism as a power system engaged in self-maintenance. For the wider view, which modifies and refashions each, mind can be delimited neither by states of consciousness however organized on the one hand, nor by physico-chemical activities however completely known on the other. As consciousness would have no intelligent character were it not for the modes of power beneath it, so mind could have no directive function were it completely distinguishable from the physical character of the organism as a self-maintainer. The essence of mind is not awareness, feeling, consciousness, but the organic modes in which power works towards enduring activities and forms.

Does mind act on body? If we mean by mind a " psychic power " which confers on body whatever intelligent character it may show, the answer is that it does not: if we mean by mind those fundamental modes which make power intelligent alike in nature and in life, the answer is that it does. And our answer must be the same when we ask whether consciousness has any causative or determining part in organic processes. If we mean by consciousness merely our awareness of what we are doing, the reply is that it has not; if we mean by consciousness the physical correlate of that awareness in brain and nervous system, the answer must come that it is so in-and-in-woven into the physical changes which it accompanies as to be an inseparable factor of them. Originally, the shock which we call feeling could not have been long delayed once organic matter had begun to function for self-maintenance. In the long, slow evolution of life from lower to higher, and finally to highest stages, it must have been gradually interorganized with the physiological processes. It has thus become a part of these processes, not in the sense of determining them or of abdicating its character as a product, but in the sense of helping to make up a whole of interadapted actions all of which require each, and each of which is necessary to all, with the result that specific kinds of psychical change are kept inseparably linked with particular sorts of physical change. That the objective shock should appear to us as consciousness remains inexplicable, as is sufficiently shown by the difficulty of describing awareness in other than terms of itself. All we can say of it is that it subsumes in brain and nervous system a highly specialized form of the same reciprocality of power which the universe itself displays. For all grades of feeling there is needed that relation of the implicated one to the including many, that swift interchange between the dominating many and the subordinated one, which are possible only in living matter and within the narrowly delimited space areas of organic systems. If on the objective side consciousness is the attitude of the system towards unorganized and quasi-spontaneous changes within it, on the subjective side it is such changes seen in the many-faceted mirror for which each organic unit, reflecting and reflected, is also at once thing and image to all the organic units.

In consciousness, as in everything else pertaining to life, we thus come back to the organism wielding itself, in possession of itself — to a system arising out of Nature, belonging to Nature, yet none the less set off from Nature by organic causation and the activities of self-maintenance. It is only because our psychical states are conspicuous, the physical states which produce them concealed, that we have been eager to promote consciousness to causal rank over that which originates it; only because, keenly aware of the teleology of our voluntary activities, muscular and mental, but shut out from the teleology of the process which underlies them, that we have clung obstinately to the view which makes consciousness the principle of intelligence and the driving power of life. If consciousness be useful in any way or degree, it cannot be useful for itself. On any view of the relation between body and mind, mind presupposes body as motion presupposes the thing which moves. And little as we can scrutinize the physical correlates of our conscious states, we are bound to assume that all these states without exception, from the simplest feeling of discomfort to the highest flights of abstract thought, are founded in non-psychical organic processes, and fit these as the cast fits the mold. The set which we have towards life and life's activities is plainly imposed, not primordially by the feelings which we have as knowers, but primordially by the physical body which we inherit and wield as doers. As the real source of organic teleology is not a psychic principle, but the nature of the organism, plus the motion process, so the real guide to intelligent adaptations is not consciousness, but the ends implicit and demanding realization in a system impelled to maintain itself. Finding consciousness present in some, not in all organisms, and absent from the whole of the inorganic world, we are compelled to believe that it is a peculiar, narrowly delimited aspect of reality, and at the same time a superficial, not a fundamental aspect of life. Finding teleology in both organism and universe, we are compelled to trace it, not to a psychical, but to a dynamic principle. Consciousness suffers nothing by being delivered from the embarrassment of irrational claims. It rises in dignity the more we can view it as the outcome of a process deeper than its own; it becomes more precious to us the more closely we can link it with life; it takes highest rank when, as revealer, it patterns forth, however imperfectly and unsatisfactorily, something of the wonderful resources of the organism and the inexhaustible richness of power.

CHAPTER XLII

NATURE AND KNOWING

Sooner or later arises the problem of the validity of knowledge, of the so-called correspondence between thought and things. Throughout the history of nature study men have asked not only how we know the realities outside us, but also how knowledge of an external world is even possible. On the one hand the organism has been credited with an *a priori* power of knowing, independently of the physical conditions from which knowing proceeds; on the other, knowledge has been treated either as an illusion, or as a convenient method of collocating, combining and classifying the facts of sense perception. In one hypothesis it is suggested that we know our environment because the laws ruling there are the same as those which control the internal processes of the organism. We have also been assured that knowledge follows from the relation in which the human soul stands to an all-including cosmic soul. And there is the view that the workings of the mind have been so divinely adjusted to the workings of Nature that knowledge of these results of necessity. But solutions like these have never had a more than verbal validity: they are one and all founded in the failure to relate knowledge to its underlying dynamic source.

Not a few of the doubts that have arisen regarding knowledge spring from subjectivism, and some of them need to be cleared away as a preliminary to recognition of the real scope and limitations of the knowing process. Most of the so-called antinomies, presenting knowledge as in conflict with itself, will be found to yield to rational treatment. They really originate in the two aspects into which knowing is analyzable. On the one hand are the conceptions born immediately of sense, on the other the conceptions which arise out of the action of the mind on the sum total of its material. A process of knowing content with the percept, and only imperfectly modified by reflection, is naturally in conflict with reason in a court of appeal to which all the evidence must be submitted. It is inevitable that deliverances of the feelings, the emotions, the will — the conative side of human nature — should come into opposition with deliverances of the intellect; that faith should find itself held in check by knowledge, and that knowledge should return ever and anon to the standpoint of faith.

Ideas may be conceivable and yet not rational; the "inconceivable" may very well be in a high degree reasonable. The first man who was informed that it is the earth which turns, not the sun that moves around it, must have encountered an antinomy difficult to dissolve. For every untutored person an antinomy starts into being when he is informed that the whale is not a fish: to convince him of the fact he needs something far other than the testimony of his senses. So for all of us color is of the object, not of the subject, heat a quality of the things heated, not a mode of motion, until the total yield of knowledge about them has been brought to bear on the problem. Sense experience convinces us that matter is infinitely divisible, and beneath our theoretical knife the imagination watches it dwindle unavailingly; reason leads us to a unit character which, being constitutive, cannot be other than indivisible. As all our experiences are of spaces with other spaces beyond them, we find a limit to space "inconceivable." Yet the problem assumes a different aspect when, with all its ramifications investigated, our "space" turns out to be no more, if no less, than that extension aspect of things which we have hypostatized into a containing vacuum for objects, just as under similar scrutiny our "time" turns out to be that succession aspect of things which we have hypostatized into a containing vacuum for events. The antinomies are mostly conflicts between lower judgments based on sense experience and higher judgments arising out of the summating activity of the mind on its material — between conclusions reached from one or a few of the elements needed for a correct decision and conclusions in which all such elements are taken into account.

It has been alleged that all we know of cause is the invariable succession which links antecedent with consequent. Yet we believe in the reality of cause not because of the habitual succession of phenomena juxtaposed in time, but because we have acquired a highly useful power of distinguishing between two kinds of such succession, one of which involves the mere succession of chance, the other of which involves a connection which is necessary and therefore causal. Knowledge of a succession which is causal, not fortuitous, arises from a multiplicity of cases, all of them showing, along with differences in superficial characters, complete likeness in fundamental characters. The object producing heat, the object receiving heat, the appearances resulting from the production of heat — these may vary endlessly; yet the oneness of the process makes itself apparent through all diversity of the circumstances. How do we know that sharp blades act causally of their objects? As there are multifarious sources of heat, from lucifer match to sun, so there are multifarious cutting instruments, from the flint knife of the savage to the machine blade of the paper-maker. They differ superficially in size, in shape, and in the conditions under which they are used; yet in whatever superficially unlike ways, and under whatsoever superficially unlike circumstances, they all do fundamentally the same thing. The evidence of causal action in the one case is thus recruited and confirmed by the evidence in all the other cases. Merely fortuitous succession, on the other hand — the occurring of one event immediately before or after another — lacks this confirmation and therefore supplies no materials for a class to which, on the basis of their fundamental likeness, a number of superficially different cases can be referred. The merely chance successions are " separates," and cannot be made to coalesce; the cases of cause-effect relation, put into the stereoscope of the reason, rush together and stand out in solid realism. It is not necessary that we should see " how the cause passes over into the effect ": it is enough to be convinced that change is actually produced.

A favorite thesis of subjectivism is that the conception of cause must be traced to experiences of voluntary action. It is said that the idea is one we should never reach were we not ourselves causal agents. When changes occur in the inorganic world we read into them, by analogy or generalization, the notion we have of the cause-effect relation as manifested in ourselves. It is because we produce effects that we recognize cause in nature. But we could accept this view without being involved in the conclusion that cause exists only for certain linkings of our states of consciousness. The evidence for causal action in Nature is bound up and is one with the evidence for all kinds of reals. It is for the fundamental, not for the superficial characters of our subjective activities, that we are entitled to find correspondences in the world at large. Why do we know things as in "time" and "space"? Not because time and space are merely convenient frameworks for containing our sense impressions, but because extension and succession are fundamental characters of the reality that is accessible to us. Why do we mentally bring likes together and separate unlikes, and why is all our reasoning syllogistic? It can only be because, in the dynamic sense, Nature is itself logical; it is because the cosmos modally anticipates and is the source of mind. The world of perception and conception is indeed "our representation," but its deepest elements come up to us from a universe of power which exists independently of both. Things conform to us for all the superficial elements of knowledge; for all its fundamental characters knowledge conforms to things. The formula "I think, therefore I am," yields no more than a subjective ground of certainty. In the larger view I am because my thinking is explicable to me only on the assumption that it proceeds from a necessary relation of thought to self-maintenance, and from a necessary relation of the self-maintaining organism to the universe. The contention of subjectivism that our conception of cause is traceable to experiences of voluntary action thus recoils on itself. Unless the organism is to be regarded as primordial, the cosmos as subsidiary, we must recognize that causal successions go in classes for the mind because causal action goes in classes for Nature, and that necessary connection belongs to certain mental states only because it first occurs in things. It is because we need the conception of cause to explain the relation of objects to us that we need it to explain their relations to one another: with nothing corresponding to the idea in Nature neither of these needs could ever arise.

Our doubts about knowledge seem most justified when we exaggerate its scope by ignoring its real function as ancillary to self-maintenance. How much do we know even of the universe accessible to knowledge? Our estimates of magnitude rest ultimately on measurements of ourselves, and on these enlarged by comparison with sizes and distances in our own immediate environment. To one set of beings, whose existence has been rendered conceivable by our knowledge of microscopic life, the world of our daily existence would expand into infinity; to another set, equally conceivable, the whole diameter of the visible cosmos might shrink to the dimensions of a mundane parish. An organism whose life existence on this planet were compressed within a range estimated in minutes could never know anything individually of the rise and set of sun or of the changes of the seasons, and the race to which it belonged might go on accumulating and handing down bits of individual experience laboriously patched together without ever acquiring a knowledge of the rotundity of the earth, or of its diurnal and annual motions. How vastly, on the other hand, might not Nature knowledge differ from ours, both in extent and accuracy were it acquired by a being whose individual life experiences extended not merely to hundreds and thousands, but to millions of years!

We are accustomed to the thought of a universe order upon which we may rely. Yet Babbage, in his ninth Bridgewater Treatise, undertook to show that changes from it are easily conceivable. He suggests the case of a human inventor designing a machine constructed of wheels and levers which would work invariably according to a simple law of action during any finite number of stages, and yet at a given moment, however remote, would develop a variation from the law up to then followed. Such a machine, after proceeding for any length of time according to a first law, might suddenly suffer a change, so that it would thenceforth begin to calculate according to a wholly new law provided for in its very constitution. After giving the natural numbers for a finite time it might begin to yield triangular, square or cube numbers, and these changes might be conceived as occurring time after time. "For all that our science can tell," writes Jevons ("Principles of Science," p. 748), "human history may be closed in the next instant of time. The world may be dashed to pieces against a wandering star; it may be involved in a nebulous atmosphere, to be exploded a second afterwards; it may be scorched up or dissipated into vapor by some great explosion of the sun; there might even be within the globe itself some cause of disruption which only needs time for its manifestation." Only a few years ago our presumedly valid acquaintance with Nature was rudely enough disturbed by the discovery that matter, instead of being permanent, is gradually undergoing disintegration. Are we sure that the process will always be gradual?

How much of the Nature we believe we know is really reached by our language, thought and ideas? Not only are we remote from any complete grasp of our objective environment; we have cognizance of only a limited number of the events and things which make it up. It is not all experiences to which we affix the label of words, phrases, sentences, but only those which recur with sufficient frequency to have "practical" value. Not merely is it that human knowledge begins with the simplest and most constant of these recurrences — with the perpetual inflow of the actions we call light, sound, odor, taste; nor yet that it progresses only gradually, and only late in the history of the race, to cognizance of such objects as the ether, electrons, X-rays, radium emanations. Even in the days of the deeper insight into Nature innumerable things and aspects of things slip through the wide meshes of our mechanisms of expression. For the minute areas of a leaf or the varying shades and tints of a sunset cloud, as for countless juxtapositions and configurations in the realm of animal and human life, language is mute. As in the external world there are objects and motions of objects, so in the world of consciousness are there areas, shades and tones — varieties of feeling, of sentiment, of desire, of aspiration, even of thought — too elusive and infrequent to be cognized into classes, and vastly too kaleidoscopic for the mind to give them any survival value that can be secured through the labels of speech.

This restriction of our words and phrases to mere fragments of Nature takes its importance from the fact that we know things, and deal with them mentally, only to the extent of our power to put objectivities into classes, itself dependent on recurrence as the very possibility of classification. Things and processes unconnected with each other by resemblance might be perceived, but could not be classified and would therefore evade assimilation into a body of knowledge. As natural objects are brought forth and natural processes carried on in classes the members of which, though superficially differing from, are fundamentally likes to, each other, so knowing is the segregation of them into classes of conscious states, each connected with the rest by likeness. We cognize a thing by perceiving that it resembles some other thing or things; we re-cognize it by referring it to a class of like things of which we have already had experience: even natural laws are the pigeon-holes or catalogue drawers into which we distribute the uniformities of cause and effect that belong together. As users of the syllogism we reach conclusions by the segregation of things as likes and unlikes; our whole resort to logic is a method of classification. And the concepts we frame for Nature are themselves either symbols, idealizations or economies — often all three. There are no perfectly straight lines, no perfect triangles, no perfect spheres in Nature; yet all these must be assumed if the art of the geometrician is to succeed. So physics denotes by exception and connotes by rule: its concepts describe things and processes not by their total nature, but by some single feature which may be used as a label for all the rest. Even in its most ambitious flights, knowledge can do little more than describe the accessible world by its most obvious characters.

CHAPTER XLIII

KNOWLEDGE AND THE ORGANIC LIMITATION

In all discussion regarding the scope and validity of knowing we must keep in mind its inalienable connection with self-maintenance. By no metaphysical artifice can we separate it from life and treat it as " going its own way " independently of life. It is frequently claimed that real knowledge is sense knowledge — that beyond percepts received through the sense organs there is an intellectual process which does not properly constitute knowledge. Yet without this process, with its ordering of the impressions into classes, its setting up of associations, its functions of recovery and review, no richness or amplitude of the sense yield would give us any real acquaintance with things properly so-called. The claim is also advanced that there is a realm of knowledge and mind action beyond that of usefulness for self-maintenance, and that in this realm the view holding consciousness and knowledge to have its *raison d'être* in utility must find defeat. But knowing can expand beyond the immediately " practical " without losing its character as useful. That it lends itself to contemplative thought and thus serves both theoretical and ideal interests is what we should expect from the method of its origin: the one application of it is involved by the other, just as the cognizance of the near objects among which men move involves the vision of distant stars centuries before astronomical science is called to the aid of navigation. In the larger sense a strain of music heard, a poem read, an upward look at the night sky may be not only useful, but supremely useful. Utility, as we have seen, cannot be rounded off in the so-called practical: it is the character of everything that exercises and enlarges function, mental as well as physical, of all activities or acquisitions that add to the powers of the mind and make the world a more interesting, a more desirable place to live in.

All the easier, in view of this range of the knowing process — at once the reception of sense material and the intellectual ordering of it — at once practical, theoretical, ideal — does it become to trace out the dependence of our experiences on the nature of the organism as a self-maintainer. It is well-nigh a commonplace to say that things have elements for us which are not in the things — qualitative characters, obvious or subtle, which it is not always possible to eliminate even when we are dealing with the objective world for scientific purposes. We find these characters pre-announced, as it were, by the differing values we read into life and nature as individuals. Each of us, with a subjectivity peculiarly his own, chooses the studies, recreations, amusements, society, that suit him best; we cherish reminiscences of times, places, people and books gathered from personal experiences. There are also the deeper subjective values which, imposed by the nature common to us, we share with our fellow beings. It is not merely that we have peculiar qualitative sensations of sight, sound and odor, the outcome of special ways in which as organisms we react to incident forces. Our need of food, warmth, light — our preferences for things that favor life, our guarding against things injurious to life — these create for us a whole series of nature values which do not belong to Nature itself. Objects and events take on special meanings for us just because we are alive, and not because of any characters which may be in the events and objects. Inanimate things come out vitalized from our contemplation of them: we read modes of human action into the uplifted pillar and the supported roof, into the spread-out landscape and the up-soaring mountain range. We anthropomorphize not because Nature is alive, but because we are organisms. As organisms we have a series of qualitative mental states which, while they sum up objective facts, mainly represent subjective attitudes towards those facts. Pleasure and pain, hope and fear, friendship, love, hate, are among our ways of experiencing and reacting from physical conditions the mere knowledge of which would fail to serve either as inducements or dissuasives, either as attractions or repulsions. We put the dependence of social welfare upon individual behavior as grist into the organic mill, and out comes what we call morality. Patriotism is a qualitative experience value in which stored-up associations plus the relation between the citizen and his society get a subjective expression. The feelings regnant in religious worship maintain their qualitative character in spite of all attempts to formulate them in objective terms.

It is not by any effort of the will, by any intellectual judgment or spontaneous choice, that life is made desirable to us, that we shrink from injury to it and toil for its continuance. We are born optimists in everything that concerns our functions as self-maintainers, and our optimism comes up to us from the very character of the organism which imposes those functions. If we could read conscious plan into Nature we should say that she strove with might and main to make life attractive, and to do this by embellishing objects, experiences, situations with a lure that is far less in them than in us. This is why we so often have wonderful moods that promise happiness without any real ground for the expectation. The healthier we are, the fuller the vital urge within us, the more enticing are the prospects that lead us on, the more eager we are to idealize the world, to smooth out the hard places travelled, to see "good in everything," to trust ourselves unfearing to the future. Life is naturally most attractive in youth, when its possibilities are unachieved and still in the making. Inducements to its continuance are then at their maximum, for the goal is not yet reached. Once the organism has realized its great ends, disenchantment begins. Living remains desirable, but there is less pursuit of it for its own sake. Intellectual values survive all languishing of the vital flame; religious values may even experience a new birth. But the functional activities, individual and social, are carried on with a diminishing interest. For many whose landscape the sun has ceased to illumine the mild moon of memory comes into view. The tired wayfarer rests awhile on the sod that is to cover him while time, which once moved so slowly, rushes past in in seven-league boots.

If human experiences in general take their color and quality not from things, but from the nature of the organism, thus also dependent on organic character is the knowing process. We have seen the extent to which the things known are acceptances and rejections, phases of existence attained or only attainable. We have now to realize that as ancillary to self-maintenance knowing makes a yet deeper choice. The suggestion of a "something" we miss, of a "being" or "entity" to which we cannot attain, comes up to us most clearly when feeling is our guide. How completely do we know the so-called "properties" of things, and how far does our acquaintance with them extend? Take the crudest bit of rock concerning whose composition and geological history we are fully informed. It is in vain that we recall, sentence by sentence, the lore that explains it, account for its stratification, harmonize its irridescent colors with formulae of physics, or trace each smooth facet and rounded protuberance to their dynamical or chemical antecedents.

The puzzle of it remains unriddled; the mystery of it grows as we gaze. Beneath our bit of rock, stretching away to unfathomable depths, we intuitively feel the something that transcends knowledge. And it is the same mystery which meets us in planet and star, challenges us in plant and flower, baffles us most in that subtlest mystery of all, our own being.

But that which feeling thus adumbrates is vastly more impressive as a deliverance of the reason. To say that knowledge is of universal scope, exhaustive, applicable without limits in the minute and in the large, would be to invest it with powers beyond those of knowledge. To say that the cosmos can be known *de fond en comble* would be to imply that its only characters are those with which the organism needs to come into relation in the interest of self-maintenance. The universe does buttress life as life's originator and support, but the amplest recognition of our dependence upon it does not justify the assumption that it exists only to produce matter, life and mind. The antithesis between organic and inorganic, the fact that Nature may be hostile as well as favorable to life, the many difficulties which surge up in the "problem of evil," all suggest that the universe may be carrying on a larger business than that of ensuring the appearance and continuation of living things. What we may depend on is that the cosmos is going its own way, even if that way involves ours — that it is working out some vast process in which life is included, but which life does not exhaust. What are we organisms in this mighty system, shut off from it in a local environment to which we must adapt ourselves, rigidly held to our narrowly delimited nature as self-maintainers, with highly specialized activities imposed by that nature, that we should arrogate to ourselves the power to explore the universe to its depths with means arising strictly for the service of ourselves and of our kind?

Science, indeed, has reached what it calls electrons; it will yet probe below these to the cosmic foundation of ether units. But for knowledge such ultimates are irreducible. Incapable of being referred to any deeper, wider class, they are not even of a nature to be "explained." We know things, moreover, only through their actions on us, through our reactions on them. What is it that acts? It cannot be action. What is it that moves? Motion it cannot be. The sense of a difference between doer and doing, carried over by us from organic to inorganic, cannot be reasoned away. It is through action that we know power — power divisionalized as number, aggregated as form, manifesting itself as extension and succession — through action that we sum up the whole furnishing of Nature in terms of likeness and unlikeness — as like and unlike ways of extending and succeeding, there classified by Nature, here classified by consciousness. Yet the power which acts, announcing itself to us either immediately or remotely through action, is itself inexplicable, though not unknowable, since explanation relates to the changes produced, not to the ultimates out of which the changes arise. Thus knowledge, rightly envisaged, retreats from the all-too-ambitious rank which has been foisted upon it to its own realm, that of life, and the cosmos opens out into limitless vistas — into possibilities beyond any terms we may use, that may be even more different from ether and matter than these differ from consciousness and will, that have no point of relation to life and no meaning for the knowing process. The sense of a something that transcends us is imposed, not by mere feeling, not even as a logical opposite, but by a supreme act of the reason itself. As the most polished reflecting surface is functionless in the absence of light, so knowledge mirrors only those features of power that are illumined for it by organic end. Above, around and beneath the nature thus accessible to it stretch the unsunned depths of a super-nature, with meanings that evade thought and put language itself to confusion:

> No sense that for ever the limits of sense engird,
> No hearing or sight that is vassal to form or speech,
> Learns ever the secret that shadow and silence teach,
> Hears ever the notes that ere ever they swell subside,
> Sees ever the light that lights not the loud world's tide.

And in a realm where language and thought alike fail us, a distinguishing name is all we can hazard. Such terms as "reality" "existence," "being," "thing," apply only to the accessible world and its contents. All such words have implications founded on, arising out of, our contact with objects through phenomena, and any application of them beyond these limits must be made with the needed reservations understood. The organism lays hold of and utilizes only those characters of cosmic power which — with whatever immediateness or remoteness, with whatever value for the practical and the ideal — serve or may serve the ends of self-maintenance, the interests of life. The real for us is that which yields appearances, phenomena; it includes all the things with which we can come into relation for adaptation and knowledge. Here is the domain of ether and matter, of cause and effect, of the space-and-time order. But beneath it, unless we are to regard knowledge as a universal solvent, there must be a realm which yields no phenomena, a super-real which is rendered inaccessible and unintelligible to us at once by its nature and by ours — a world which shuts us out from comprehension of it as the crossed tourmaline plates shut us out from the light.

Now modern discussion of the knowledge problem finds its unknowable not in a super-real, but in the real itself, and sometimes does this on the assumption that knowing might be more efficient were it other than we find it to be. "A little reflection," it has been suggested ("The

Principles of Science," Jevons, pp. 33–34), "will show that knowledge in its highest perfection would consist in the simultaneous possession of a multitude of facts. To comprehend science perfectly we should have every fact present with every other fact." But "a little reflection" will also show that perfect vision would consist in seeing objects, not merely by reflection of light from their surfaces, but in seeing every part of them, interior as well as surface, unit as well as totality. If vision could be improved by a phrase we should need neither microscopes nor telescopes, could probe without instrumental aid at once to the electrons and to the farthest stars. It is said, again, that the relativity of knowledge is itself a defect, and that if knowledge were "absolute" we should be able to penetrate to the truth of things. Here is another naïve effort to "perfect" knowledge out of all semblance to its real self. For knowledge is by its very nature relative — involves the relation between subject and object, the serial method of comprehension, the cognition of things by putting them into classes, by separating them as unlikes, by bringing them together as likes. The assertion of its relativity is a proclamation, not of its defect, but of its completeness. To speak of "absolute knowledge" is to deny with our adjective what we assert in our noun.

Fallacies like these easily widen out into the claim that we know, not noumena, but only phenomena — not things, but only their appearances. When we perceive a tree, and by cognizing it refer the object to its class — recognize it as a tree — we are said to know only the aspect which it presents to us as observers. There is something in the object, it is maintained, that is not given in the knowledge we have of it — something which, being its real nature, evades our knowing faculty, and would escape us however exhaustively our senses might take cognizance of its properties — however minutely, by naked-eye observation, or by microscopic examination, we could explore the whole texture of the tree down to its very atoms and electrons. By this hypothesis all thing-objects of which we have immediate perceptual experience are divided into two natures — their nature as appearances and their nature as noumena or " things in themselves," it being held that while we attain to the one, the other, the " real " objects, are forever inaccessible to us. The whole view seems favored by — probably arises in a measure from — the manner in which we know objects through vision: they are presented to us as surfaces the qualities of which appear to be spread out at a certain distance from us on the objects perceived. We take these surfaces as the " show of things," and imagine that in some way there must be entities beneath them to which we do not attain. The main reason for the supposition that we do not know things, but only their phenomena, is that we treat the appearances as the objects of our knowing instead of as the conscious states through which objects are known. The phenomena represented in these states are taken for the end to be attained, instead of as the means of attainment; missing their functional value, we stop short at the appearances and regard them as that which is known. Being aware that we have conscious states we treat our awareness as a knowing of those states — suppose the appearances to be the objects known — and thus view phenomena as the terminus of a process whose real goals are the things we perceive. It is as if in vision it were to be said that we never see an object, but only the image of it formed on the retina.

We must thus be on our guard, alike against the supposition that knowledge is exhaustive of things, on the assumption that the whole cosmos is of a nature to be known, and against the not less delusive view that the knowledge we have of things is no more than a substitute for the something it ought to be, and might be, but is not.

No disparagement of it can be found in the fact that it is a definitely delimited method of getting acquainted with things in the interest of life rather than an inadequate beginning of some other imagined method of knowing whereof we have no example and of which we cannot rightly conceive. As seeing is just the perception of images formed on the retina, so the knowing of things is just the acquaintance we gain of them in and through appearances — just the outcome of a function which is performing its work and performing it adequately. That knowledge exhausts all of the real cannot be maintained. The material is vast, selection from it for the needs of self-maintenance inevitable, and the knowing of it a gradual, a progressive acquirement. Our immediate knowledge is made up of the material furnished by way of the senses, and the senses have been developed in the interest of acquaintance with those characters of things which serve life most usefully. Objects doubtless have other cognizable properties than those to which we have actual access. Senses are conceivable other than those which we possess. Yet such attainable characters, even when not attained, are all within the realm of the real — theoretically knowable, and sometimes coming within our purview either indirectly through the senses or as verifiable assumptions deducible from sense experience.

What the noumenalists assert is that the real is inaccessible to knowledge because of the inadequacy of the knowing process; what is here asserted is that we have knowledge of the real because of the efficiency of that process. Our unknowable is the super-real, from which we are excluded by the very nature of the organic limitation; their unknowable is the real, from which we are said to be shut out by the very process which constitutes knowing. To us who are not noumenalists the whole world of phenomena-yielding reality — the world to which the character of the organism as a self-maintainer relates and admits us — the world to which we must adapt ourselves and utilize — is open to be known. Their cosmos, even as real, hides from any true disclosure of itself behind an imperfect method of knowing it; ours is a cosmos of infinite richness which turns one ray of its many-hued spectrum towards us and submits that ray unreservedly to our knowing faculty. Relieved from the embarrassment of fictitious claims, but clothed in its true powers, knowledge thus takes on in its own domain a completely adequate validity. But even within the real it is there strictly for the service of life and can have no extra-organic meaning either for nature in the minute or for the cosmos at large. Similarly linked to self-maintenance is the conception of truth. Since nothing is known save as taken up into states of consciousness, so nothing is true or false save when realized as such in some mind. And the truth about Nature is something more than either its "working" function or its usefulness. A true conception or idea is not true merely because it is useful or because it "works"; it is true because of a correspondence with reality — reality of both knowing organism and things known — which enables it to "work" and makes it useful. And the test of its truth as thus founded, while it may be narrowly applied by individual conditions and for particular ends, is ultimately applied by the larger experiences and interests of the race.

It is with the sense of the super-nature in our minds that we shall find relief from the criticism so often urged against general statements about the cosmos on the ground that they do not involve the results to be evolved. How, it will be asked, shall the known outcome of the universe process arise from a system of power units exerting stress and receiving stress, each subordinated to all, all dominating each? What final virtue is there in pressure however mighty or minute, in action and reaction however reciprocal, in interdependence however rigid, in differences however divergent, in likenesses however complete? How are we to win the wonders of Nature, life and mind from actions gravitative, chemical, electromagnetic, from electrons, atoms and molecules, from matter in motion and matter at rest, from matter diffused, from matter collectivized? We need to remember that our names for things and processes can only describe their most general characters, and that, with the product in plain view, we are not estopped by the descriptive limitation from tracing results to their manifest origins. Is the simple notion we are compelled to form of a seed invalidated because we can not include in it the mighty trunk, the far-spreading branches, the multitudinous leaves, nor yet the complex commerce with soil and air and sun through which the life of the tree is maintained? Must it be held that man himself, with his bodily activities and far-ranging mind, with his feelings and desires, his ideals and his heroisms, is not deducible from the tiny speck of germ-plasm in which all these originated, merely because we are obliged to sum up that speck in a few concrete accounts of microscopic structure and in a few general statements about potentiality? The negative answer to questions like these would come even were material nature exhausted by our descriptions of it; the deeper reply is suggested when we realize that, valid as is knowledge in its own sphere, such descriptions connote, beneath all the characters accessible to us, a realm which turns our subtlest interpretations, whether of feeling or intellect, into mere surface meanings, into recognition marks on the exterior of things, into labelings of the unfathomable.

Note finally that the positing of a super-real does not entitle us to see beyond the real for that anthropomorphic teleology which is denied to us within it. If we are not justified in reading psychic powers into Nature, with what reasonableness shall we endeavor to project them into the super-nature? How shall that which is intelligible be explained for us in terms of the unintelligible, or the something that transcends knowledge furnish us with the key to that which is accessible only through knowledge? Plainly nothing is left for the intuitionist but the resource of mystery, and the appeal to mystery stultifies both appealer and appeal. Thus the age-long attempt to objectify man in Nature, advancing from methods gross to methods refined, has its final outcome in his complete elimination from Nature. For whether our temper be scientific or religious, the more deeply we gaze into the ocean of existence the fainter grows our human reflection therein, till at the deepest reach of all it vanishes utterly. Yet it vanishes as an anthropomorphic value only to give place to that more rational image in which man's striving towards ends, shared in various degrees by all animate and inanimate nature, find their source and meaning in the universe itself.

CHAPTER XLIV

KNOWLEDGE AS PURPOSIVE

The organic system differs from the inorganic, as we have seen, in having its parts interdependent, subordinated to the whole of them and dominated by that whole; out of its active resistance to disintegration come self-maintaining activities, organs and finally conscious states, culminating in mind. Neither the general nor the particular ends of self-maintenance are foreseen by the system after the fashion of a plan devised beforehand and consciously carried into effect: they are implicit in the organism as a way of working to which it is rigidly held by its nature as a self-maintainer. Just as the "affinities" of the chemical atoms "look forward" in a physical sense to the molecule which they are to form, and as the molecules look forward to the crystal which is to arise from their laws of combination, so does the organic system, though in a vastly more complex way, look forward to the structures which are to be useful for its conservation. Certain ends come at last to be consciously planned and reached, yet beneath all illumination of them — in advance of plan, forerunning and supporting design — is the self-maintaining, purposive character of the system.

In all this we must bear in mind the basic difference which separates the action-reaction which is organic from that which is inorganic. The inorganic object shares its principle of "behavior" with its inorganic environment, for one rule is imposed on both. With exceptions and to the extent noted in a previous chapter, it has no past experiences to take account of; its properties remain the same whatever its history may have been; it "behaves" according to modes that never vary; its action-reaction is ready for delivery from instant to instant and confines it rigidly to the present. The living object, on the other hand, has its principle of behavior wholly in itself, with bases of action not only in the present, but also very largely in the past and, so far as action must be prefigured, even in the future. Highly complex and sensitive, subject in new experiences to the results of old experiences, the organism confronts a continually changing environment, and is by its own activities sooner or later involved in continually changing relations to that environment. Beyond the reflexes which are set up automatically in the lowest forms of life, the system must develop organized means of dealing with incident forces, of relating itself to objects, of meeting situations simple and complex. And these means involve what may be called a physical plan of action which has its psychical side in the organized conscious states we call knowledge.

The organism takes advantage throughout of what it finds. It is able to utilize incident forces for its guidance first because they differ for different objects and are like for like objects, then because the existence of external things and their activities in natural classes as likes and unlikes makes it possible to store them up for cognition and recognition as mental classes. It is by a similar noting of what exists outside that it is enabled to distinguish between the fundamental likenesses of objects and their superficial differences — between characters which all objects possess in common and characters in which individual objects differ from each other. These common characters, being continuous and permanent in their action, make the deepest impression and thus become in their effects the ground of the less constant and more fleeting impressions — the framework, so to speak, into which all merely superficial characters fit themselves. The so-called *a priori* forms said to be imposed by the mind on objects are really the fundamental forms which in the long history of animated beings objects have first imposed upon the mind. The definite shapes, sizes, colors and other peculiarities of things are never exactly the same: the abiding character in which all objects are alike is their extension, their spatial character; and that is why our senses, while noting individual differences, present all objects to us as spatially extended features of a spatially extended environment. A like origin has been claimed for time or succession, but it can be sustained only with a qualification. Space is a character of physical things, but not of our states of consciousness; time is a character of our states of consciousness as well as of objects. We should know nothing of space if we were limited to these states for knowledge of it, but it cannot be said that we should be unaware of time if we were excluded from acquaintance with our environment. We carry materials for the sense of succession within us; we need physical objects to give us the sense of space. Vicissitudes of environment, moreover, are much less in evidence than the extension character of objects: not every object we see is so visibly in process of change that we can get from it the notion of time, and most objects are not apparently undergoing change at all. The idea of time comes up to us most manifestly from within, and we have its materials within us because we are to that extent one with a world which is at once spatially extended and undergoing change.

The "qualities" we perceive in things have been differentiated into primary and secondary, the former including such characters as color, taste, odor, sound, the latter characters like form, size and spatial extension generally. It is the primary qualities which are of chief import for us in dealing with environment, and the way to the knowledge of them is through the secondary qualities. But there is no inherent utility for us in an object being blue, green or yellow: colors, like smells and tastes, take their value from the fact that they enable us to recognize and identify given objective things, to distinguish between them and other things. Grass might be yellow and coal green without affecting our knowledge of these objects in the least. The things which now taste bitter might taste sweet without inhibiting our power to distinguish between and identify things sweet and bitter. But the so-called primary qualities are in no such sense indifferent: if an object appeared round when it was square, long when it was short, near when it was remote, the interests of self-maintenance would suffer. The essential thing in the primary quality is that it shall show how the environment is constituted, how its objects are shaped and located, how they are spatially and causally related to each other. The essential thing in the secondary quality is that it shall serve as a label or recognition mark for the primary quality; without the secondary qualities we should know nothing of the primary qualities. While therefore the primary quality has objective reality in the sense indicated, the secondary quality is mainly the organism's way of dealing with the incident forces through which the primary quality, or what it denotes, becomes known.

How is knowledge of an environment of spatially extended objects developed? To maintain itself the organism needs to be aware of how near or far these objects are located, what are their sizes and shapes, how distinguished from and how connected with other objects, how acting and interacting. It must get this knowledge through its sensations, and the knowledge must be reliable. At the beginning there could be only a rude approximation to guidance of this kind. Feeling and reaction from feeling were the earliest form of adjustment, involving no more than the experience of simple contact with objects. The movements resulting in such contact brought a primitive sort of awareness to things outside, not going beyond their most general characters. Gradually, in reaction from special kinds of incident forces — selected, as it were, for their guidance value — the senses of taste, smell, vision and hearing were developed. At first the adjustments would be more or less automatic; out of the reflexes instinct would arise as a series of mental rules for a few block conditions and a few generalized incident forces. With the growing sensitiveness of the organism and the increasing complexity of self-maintenance the objective classes would be analyzed out into numerous subclasses and into superficial variations within these. The general responses would then no longer suffice: more precise adjustments would be called for, involving modifications of instinct and a growing resort to memory, deliberation and choice. Attempts have been made to split instinct and intelligence into two separate faculties, but the division cannot be maintained. Instinct is the guidance provided when block actions and reactions suffice; "intelligence," using that term in its conventional sense, is the guidance needed when the organism has outgrown its highly generalized methods of dealing with environment. The two are obviously linked by the fact that they are both means of reaching organic end and therefore purposive.

Of all the means of acquaintance with environment we are most interested in vision, because of the intensity and value of the impressions; and vision may here be taken as the type of all other sense modes of knowing objects. The most useful kind of awareness is obviously one which enables us to realize them with their distances, forms and other peculiarities accurately indicated. Sensations are felt at the surfaces of or within the body, and if they remained internal we should have no real guidance to the world around us. What happens is that by a sort of mental projection, due to a domination of its material by the mind, we refer the sensations objects produce in us to the environment. But without motion through that environment, without exploration of it, involving experiences of contact, touch, and manipulation, this appearance of things as external to us could never arise. We locate them in the outside world because our acquaintance with it through motion teaches us that they are there, and it must have been in this way that everything apprehended by sight got its final vision value: with vision experiences corrected and informed by feeling experiences, the rule set up for the proximate would also serve for the remote. The eye mechanisms were meanwhile plainly developed in the interest of an accurate acquaintance with objects. A lens, focusing light on a sensitive retina, rendered the vision sensations precise; by distinctions between images large and images small, between things seen out of focus and things seen in focus, it made estimates of distance possible. Double vision, partly due to the pronounced bilaterism of all the higher organisms, brought the advantage of stereoscopic effect; it helped knowledge of the spatial characters by giving the impression of solidity. Double vision is superior to single-vision even when there is no stereoscopic effect, as in some of the lower animals; bilateral vision is still more useful when the flattened front and non-prognathous mouth are finally developed. The eye lens is an unconsciously reached anticipation of man's resort to the lenses of the microscope and telescope; so double vision anticipates the astronomer's resort to parallax as a means of determining the distances of planets and stars. If it be asked why we see objects erect, as they are in the environment, in spite of the fact that images appear inverted on the retina, the general answer is that sensations are under the control of a process which works to give them maximum efficiency for self-maintenance. Feeling experiences are here also at work: indications are given by the muscles which move the eyeball; the head is raised in order to bring the upper portions of objects into view, just as it is lowered for their lower portions. The distortions of perspective do not deceive us.

There is mediate as well as immediate acquaintance with the world of things, the latter consisting of direct sense experiences, the former elaborated out of those experiences; both together make up knowledge in its totality. The requirement for knowledge of the real is not that it should be solely in terms of sensation, immediately delivered by objects, but that the total mind system should have these terms at its disposal for that larger grasp of things which mere sensation alone can never supply. Sensations, reactions from incident forces, would be without form and void were it not for a power which, bearing down on the physical correlates of the conscious states, segregates, organizes and correlates them in ways that yield the maximum utility for self-maintenance. The mind is such a power, and we can only mean by mind not the sum of the conscious states, but the total brain and nerve system on which the function of guidance has been imposed. It is this system, the organism behind it, which works to put the sensations into object classes and causal classes, to expand cognitions into propositions and ideas, concepts into trains of thought culminating in judgments, and so to correlate, utilize and wield the conscious states as to ensure that all situations to be met, vary as they must, change as they may, shall have their interpretation, guidance and rule, and life its furtherance. First automatic and unconscious in its working, then conscious and voluntary, the mind is active throughout organic ascent, and its powers get their development not in individual isolation, but in contact and interplay at once with Nature and with other minds. As panmixia must be understood for the physical, so also must it be understood for the mental side of self-maintenance. For all individual developments the species or society is also potently at work in sanction and in veto, in delay and in acceleration.

The mode of motion, the law of change, the process of advance are the same in both fields. The reaching of organic end by motion away from the direction of greatest towards the direction of least stress links together all the stages through which the organism develops its sense picture of the external world. Every imperfection in our realization of that world is so much power wasted; every advance towards such realization is so much power saved. And as waste of power means differential stress, saving of power advance towards equalized stress, the gradual change from configurations that permit the one to configurations which achieve the other is inevitable. Impelled not only to maintain itself, but also to attain the highest efficiency and economy in maintenance, the organism goes on improving its sense organs and the deliverances of these until the correspondence between the mental pictures of things has been carried to its utmost attainable maximum. And what is true of sense knowledge and its mechanisms is also true of the higher mental processes which use the sense yield as their material. So long as the organic units which function in these processes are working under eliminable differential stress they are wasting power, and that stress is constantly urging them towards the places, forms, configurations, every advance towards which is an economy of power. Knowledge mediate and immediate which fails of the needed accordance with objective realities comes under the operation of differential stress and is by that stress either modified or eliminated. And it is this ever-acting inducement to the saving of power, to efficiency in maintenance and to enlargement of the scope of maintenance which, idealize it as we may, is the source of all advance in knowledge and of all aspiration after what we call truth.

Knowledge is thus obviously purposive and takes its end-reaching character from the organism which it serves. If organic self-maintenance is a derived form of cosmic self-maintenance and knowing is ancillary to life, we are entitled to find in the mind process a parallel for the characters revealed by the universe process. The whole of knowledge, in fact, — its physical correlates understood, — shows an advance from separateness to collectivity, from the more or less absolute to the more or less related, from a condition in which the involved units are in a sense self-sourced to a condition in which they are more or less system-sourced — from a method, as it might be called, of treating them as if they were independent of each other, with inherent, non-derived powers, to the recognition of them as interrelated, contingent, linked up with the system to which they belong and to that extent coöperating. As all progress from lower towards higher material forms is progress from this kind of individuality towards this kind of collectivity, so all advance in knowledge is advance from stages in which perceptions, concepts, ideas, go their own way, are treated as more or less independent of each other, towards stages in which they are collectivized as members of an interrelated, interdetermining and dominating system. It has been said that we can be acquainted with a toothache without needing to be acquainted with anything else, but that proposition is tenable only to the extent that the toothache is a feeling. We cannot know what a toothache is without knowing about a tooth and all that enters essentially into knowledge of it as aching. So we may be acquainted with a tree without needing to be acquainted with other objects, yet we cannot have complete knowledge of it without knowing it in a sense that connects it not only with all trees but with all plants, and finally with matter in general, as well as with energy in general. Remote as seems the reinforcement, it cannot be held that our knowledge through telescope and spectroscope of far-off stellar systems and nebulae does not enrich and amplify our knowledge of the matter we have around us on the surface of our own planet.

We reach here the difference between the lower and the higher activities of the mind, between the cruder forms of acquaintance with things and those which are in an especial degree the province of philosophic thought. The function of philosophy is to see the general in the particular, to discover likeness beneath difference, to connect units with their systems and systems with their units, and thus to relate and unify what else would be sundered as absolutes. In a sense philosophy is the whole dominating the parts: some products of the mind must come to it for veto, yet all depend on it for sanction, for enrichment, for completion. It is the power of the system: by it the thought units are marshaled and ordered into harmonious, intelligent, purposive and therefore enduring forms. Taking all knowledge for its material, philosophy subordinates special deliverances to the yield of all deliverances; as against the partial truth in any field it is supremely the champion of the whole truth.

CHAPTER XLV

DETERMINISM AND FREEDOM

It is in viewing the cosmos as at once creator, material created and process of creation — in recognizing all change as ultimately imposed by the power system which we call universe — that we find ourselves face to face with the historic problem of human freedom. The objection arises immediately that our cosmic whole, as here envisaged, is throughout "mechanical" — a system of pushes and pulls, of motions and arrests of motion, wherein effect follows cause and cause precedes effect unerringly; that it is not a universe where freedom reigns, but a universe over which "iron necessity" presides. Is a cosmos conceivable on any other terms? In what respects could superiority be claimed for a universe in which things had no definite nature, properties varied from instant to instant, and events happened according to no rule, or rather according to all rules? If in this sense anything could be or occur anyhow, anywhere, a chaos, not a cosmos would confront us. Nothing living, still less anything human, could arise from such a negation of definiteness and order; even if it did mysteriously appear amid "things" it could have no active relations with and no consciousness of them. A proposition having all meanings is meaningless; a path leading in all directions leads nowhither; a body capriciously displaying all properties, but anchored in none, is the equivalent of nothing. The conception of a universe thus indefinite is a pseudo-conception, and our supposed dilemma subsumes a contradiction between determination and freedom which has no foundation in fact. It is based on the notion of absolute spontaneity — spontaneity of existence on the one hand, spontaneity of action on the other — and that notion negatives the very nature of the power to which it is compelled to appeal. The indispensable precondition of freedom is the definiteness which power must have if it is to be power — definiteness of nature, involving definite properties, definite location, definite conditions — that definiteness, in a word, which makes all the difference between something and nothing. And it is from such determinateness, such definiteness, that the very possibility of freedom flows, and not from a supposed lack of them which an object could utilize in being spontaneously "anything it chooses." Only from a cosmos bound to that extent by "iron necessity" can the order arise which is "heaven's first law," and only from such a cosmos can come forth life and organic freedom.

But all implications of "the mechanical" are not removed by conferring definiteness on the universe of changing things. A cosmos is conceivable which would be at once perfectly definite and perfectly orderless. For what do we really mean when we speak disparagingly of the mechanical? To say that something is "machine-like" takes account of only half the facts. A machine is an extension of the human organism, has arisen for the realization of human ends, is an embodiment, however incomplete, of human purposiveness. It carries on no internal processes, does not repair itself, has no adaptive powers in relation to environment; but its parts are not indifferently put together, collocated as by chance, acting on each other in ways that lead anywhither, and therefore nowhither: they are so correlated as to secure that end of the whole of them which is the real significance of the machine. If the term "mechanical" is to be used in any injurious sense we must cease to associate it with the machine. It must be regarded as implying interactions not bound together by a tendency to which they all contribute, cause-effect relations which exhaust themselves in the acting parts, " attractions " and " repulsions," pushes and pulls that go on undirected by a dominating whole, changes in constitutive units conceived of as structurally independent of the aggregate which they unite to form, and therefore as self-sourced rather than a system-sourced. As there are no things in the universe thus " going their own way," the characterization of it as " mechanical " cannot be maintained, either as signifying that it is " machine-like," for that would make it the product of an organism, or as meaning that no large directing tendency presides over the action-reaction clashes within it, for that would be a denial of its manifest purposiveness as here set forth.

But now another corollary from the conceptions of definiteness and necessity confronts us. If changes follow inevitably from the fixed natures of things, how shall the universe process yield freedom? If the organic is fundametally one with the inorganic from which it emerges, how shall we deliver life from the iron rule that sways over the chemical combinations, determines the fall of the loosed boulder and impels the stars in their courses? We need here again to take counsel with ourselves. What do we really mean by freedom? Spontaneity we cannot mean. Man is no more free to be anything organic or inorganic at will than the molecule of oxygen is free to be a molecule of hydrogen, the river to be a mountain range, the mammal a bird. Even the popular conception of freedom as a way unimpeded, a right not interfered with or thwarted, implies a definite nature to be expressed, definite activities to be carried on. In what, if in any sense, does the organism determine this nature and these activities as the result of an option between alternatives of which it selects one? We do not choose to be animate as opposed to inorganic; we have life thrust upon us. As organisms we are rigidly restricted to the internal and relational activities proper to organisms — restricted also, as human organisms, by thousands of conditions which we have had no part in imposing and from which we can be delivered by no exercise of will or of thought.

Appearances in the organic world do suggest spontaneity. Flies disporting themselves beneath the ceiling, birds darting hither and thither through the fields of air, animals pursuing the business of life on the firm earth, all seem original sources of their own behavior. In man this doing of things at will, independently of what external things are doing, and at the beck of no causal impulsion from without, seems a conspicuous feature of human behavior. It is only in the most general characters that such behavior can be predicted: in detail it utterly evades prediction, as it evades all formulation into law. Cause-effect relations in the inorganic are simple, direct and immediate; in the organic they are so excessively subtle and complex, so far fetched, spread out and subject to delay as to make recognition of them always difficult and frequently impossible. We have here a time-and-space whole which in action and reaction must take account of an organic past, present and future; of former experiences, stored-up memories, desires and plans by which they must be realized, none of them the same for all organisms, all of them varying from individual to individual. And this is why a telegram — a few ink marks on paper — will impel one man on a mission round the world and leave another unmoved; why the tremor of a human voice, hardly potent enough to stir a leaf, will hurl a million men against the foe in battle; why the most trivial incident will determine a life's career or set up a process of reflection which, put into action, helps to transform a whole society. In all such cases the effects are utterly incommensurate with the cause; in none of them is the reaction "equal" to the action; and the reason is, not that determinism is lacking, but that the factors are on different planes. What we see is a physical action of some kind expanded into a form of behavior by a living aggregate which, in providing response, takes into account its own nature as a self-maintaining system. The organism does react inorganically as well as organically for it is a physical aggregate as well as self-maintained. But while a man who meets with an accident has a physical shock, this lower kind of reaction does not explain why, after breaking a limb or falling into sickness, he should make his will.

The organism, while free, is thus no more spontaneous than the object which is inorganic. Freedom is not emancipation from determinism into spontaneity: it is the higher form of determinism which comes in with life — the self-direction of a system which, instead of being merely pushed and pulled, maintains and therefore wields itself. Such a system is freer the higher it ascends in the scale of life, the more complex grow its relations to environment, inanimate and animate, the wider and deeper becomes the total complex of interests which, as a time-and-space whole, it must take into account. There is least freedom for its actions and reactions where they are most automatic, as in tropisms and instinct; there is most freedom for them where its movements and manipulations are the outcome of conscious deliberation and plan. More of self-direction is needed for carrying on a train of thought than in completing a scheme of action. The intellect, dowered with the power of abstraction, is freer than the will under the sway of the emotions. Freedom reaches its maximum in the higher activities of the mind: in them the human organism is most unified, acts most in its totality as a time-and-space whole, is most in possession of itself and of its social inheritance.

If there is determination of the individual organism to organic activities in general, there is determinism also in the superficial variations which such activities show within their class. Man is under determination by society as well as by nature, and is no more spontaneous, yet no less organically free in the one case than in the other. In both cases the actions of the individual arise out of all the causes and conditions. Alike in "doing right" and in "doing wrong" he acts organically — is at once free in the sense defined and under determinism; and it is this combined freedom and compulsion which make him responsible for his conduct. A man injures himself and society if he fall into evil ways through adopting the view that, as all his activities are caused, they are all natural and inevitable. He benefits himself and society by adopting the view that, while human actions are determined, he has the power and it is his duty to reject the evil and prefer the good. But he is "free" in both cases, and he escapes from determinism in neither, since his views and beliefs, their physical correlates understood, are causal agencies. We sum up the case against spontaneity when we trace right acting to good heredity and favorable environment, anti-social behavior to bad heredity and unfavorable environment. We assert the case for freedom under determinism when we educate the young, work through speech and the printed word to influence opinion, and bring "moral suasion" to bear that appropriate action may result.

As the organism needs universe determination to make it free, so the human individual can be free only as he is under the determination of society. It is the recognition of the subordination of his personal interests to collective interests — of his powers and conduct as system-sourced rather than as self-sourced — which delivers man, rescued from absorption in nature, from a hardly less depressing subjection to his group, his nation and his race. If he can be a self only as his capacities are originated and buttressed by the system of selves, the limiting social forces take rank among the very conditions of his freedom. By far the greater part of each human being is behind him and outside him in the social time-and-space system of which he is a member. His power to "sport," to move forward to new things not inherited or imitatively acquired, turns on the degree to which he is related to that system, and through it to the all-dominating universe.

If man be thus exalted by liberation of him into the freedom of his own organic nature, life also rises in dignity when we think of it, not as something independent of the world and imposed upon the world, but as a derived form of cosmic self-maintenance arising out of the world. For we must mean by " world " not something lower than life, but something which holds hidden in its depths powers and possibilities to which knowledge does not admit us and which language can only misdescribe. And we degrade neither vitality nor mind, the product of such a world, by regarding both bodily adjustments and conscious adaptations as life-furthering, with advantage for organic interests as the sufficing end of each. Self-maintenance cannot be pared down to the mere getting and assimilation of food, the development of tissues and organs, the repetitions of heredity, the protective care of the body and the avoidance of danger. It is not rounded off by the intricate and ever-multiplying adaptations of man to Nature, of the human individual to society, and of society to the individual. It includes the whole vast complex of activities, thoughts, purposes and ideals which are involved in function and arise out of function. The simplest requirements of self-maintenance, rooted as they are in the physical, expand as they may from structure and motion into mentality, from feeling into consciousness and self-consciousness, and from the concretes of these into all that is vague and abstract, drag at each remove their " lengthening chain," and are kept by the method of their origin inseparably joined to the total interests of life.

With the universe creative, our own originating powers acquire a worth they could never have as peculiar; with the universe fundamentally purposive, our own planning, linking us in a common process with the whole prevital order, gains a support, an intelligibility and a value which the merely subjective view can never supply.

Another gain will also be ours. Humanity in the mass, compelled to take life for granted, views it as having absolute value. The poorly stored and untrained mind gives this unlimited validity to all that comes within its ken. For it things exist in their own right: they can be summed up and rounded off by what we can see and hear of them — by the extent to which they fit into merely personal conditions and needs. On this plane, where men do little more than vegetate, there are no questions of origin, no relations of dependence and interdependence, no subordination of the one to what we can know of the many. Everything — sensations, concepts, emotions, thought processes, ends and ideals — is as given. Hence the enormous importance of personal experience and of the absolute estimates placed upon its value; hence also the automatism of so many human lives. As a reaction from this naïve taking of things for granted came the old quest of nirvana, founded on the notion that life could be negated by the very powers given for its support. It was an attempt at flight in an airless realm where wings availed not. Happily there is a wiser nirvana which at once chastens our optimisms and saves us from the folly of renunciation. Near its mountain top, welcoming life yet transcending it — neither over-elated in joy nor too much depressed in sorrow — superior in a sense to both evil and good — we attain that final command of our experiences and thoughts which is freedom's precious yield and most sufficing satisfaction.

CHAPTER XLVI

ABSOLUTISM AND THE LARGER SELF

It has already been shown that the teleological view and the mechanical view go together. Note now two objections which may occur even to those who accept the view of purposiveness here outlined. If the universe process is dynamic in character, a differentiation of ether into matter, a setting of matter in motion, a collectivization of matter, a synthesis of material aggregates and a production of such aggregates into moving systems, to what extent, if at all, may the account of such a process escape the reproach of " materialism " ? If life activities, determined by the nature of the organism, are fundamentally directed to securing its survival and perpetuation; if mind is inextricably linked with the vital processes which find their goal in these ends — why should not will and thought be in a condition of complete vassalage to the organic nature which has brought them into being and in whose service they alone have meaning? With consciousness arising out of the character of the organism as a self-maintainer and closely correlated with its underlying physical states, how does it happen that men are able not merely to have memories, but to summon them up at will — not merely to have conscious states, but to be able to recall, wield and marshal them? Whence comes it that in thinking and willing they are able to overlook, curb, check, in many ways even to transcend the physical make-up of the organism to which both willing and thinking are due? And if men do exercise these powers, how can we describe consciousness, thought, mind, as ancillary to self-maintenance or regard them, in contrast with the bodily processes, as otherwise than "free" — as imposed upon the the organism from without by something foreign to it rather than as developed for its guidance from within?

As preliminary to the reply appeal may be made to certain results of the absolute tendencies of thinking which find mention in the chapter entitled "The Factor of Illusion." It was there shown that, in the absence of any sufficing intellectual process, we take things as absolutes, as going their own way, as self-sourced rather than as system-sourced, as existing only in the here and now instead of as time-and-space wholes. Into freedom from absolutism the mass of mankind never escape. Within narrow fields, and for things which have an obvious growth period — for objects which are conspicuously connected by action and reaction — there is a certain realization of them as time-and-space wholes, and thus a certain linking of a few objects into something like a system of interrelated parts. To this extent, in his daily converse with environment, the average man does appreciate interdetermination and apprehend relation — knows within the range of his own interests "how to get along in the world." But for him there is no expansion of this attitude to the inner realm of things or to the wider field of nature and life. Objects are taken for "what they are," and not also for what they have been and will be. Where dependence rules there independence is too often assumed. The individual is locked in the conception of himself as an absolute fact which could not by any possibility be other than it is — as the original source of the process which works itself out in him, and as imposing that process on nature rather than as receiving it from nature. It never enters his mind to ask by what mystery of determination he came to be this particular "I"; as little does it occur to him to reflect that he might have been somebody else; far away from him is the thought that there may be an order of nature forms, laws and processes altogether unlike to ours. The ends men pursue, their daily avocations and amusements, their acquirement of wealth and pursuit of pleasure — all have for them an absolute validity, not to be inquired into, but to be taken for granted. And the outcome of this failure to relate, to realize things as system-sourced rather than as self-sourced, is the slumber of absolutism in which most human beings transact their daily affairs and pass their lives. The general world regards as least somnolescent the "wide-awake" individual who, keenly sensitive to the surface of things, responds most alertly to concrete situations; yet it is he who is usually most asleep in absolutism. Much lower is the rank which it gives to men in whom the intellect is more active than sense, who surrender the showy and facile competence in superficials for the deeper grasp on fundamentals, who live not only in the near and now, but also in that which is before, beneath and beyond them; yet it is these who are really awake. And in contemplating the two types we realize why the address to the moment, made in "oratory," is so effective in its appeal as compared with the printed word, which permits and invites deliberation; why popular audiences are more quickly won by mannerisms than by ideas; and why the shallow speaker with a loud voice and an energetic delivery so often commands the applause which his utterances do not deserve.

Consider also some of the absolutisms which have delayed our knowledge of Nature. For centuries man took the absolute view of his own world; only after centuries could he emerge from geocentricism into the thought of a planetary system related to other such systems in an all-including universe. There are still theorists who regard the earth as the only planet inhabitated, as there are theorists who believe that life and mind have reached their highest levels in man. Nor is science wholly free from these illusions. We see them in the crude hypothesis of "attraction" and "repulsion," locating the cause of motion in the matter units themselves, as if no system of power had to be taken into account. So to-day many a biologist seeks his solution of the life problem not in the organism as a time-and-space whole, but in some property of the cell or in some mysterious configuration within it The conspicuous details of heredity as revealed in Mendelism are allowed to cover up the inner meanings of heredity; natural selection is made to do duty for the internal factors which make the organism purposive; we talk of the origin of species as if the origin and meaning of life were not our first and deepest concern. The living body has come to be treated as an object among objects, as differing from inorganic things only by the high complexity and mobility of its units and by what is curiously called the "irritability" of organic matter. That it has an original endowment, due to the relation of part to whole and whole to part, is never suspected. The anxiety of the Darwinian is to find out how it comes to be battered, as it were, into purposive adaptations for self-maintenance; the anxiety of the Lamarckian is to discover by what response of structure to need and use, apart from any underlying process which imposes structure and gives rise to need, those adaptations are set up. There is failure in both theories to recognize the organism as inherently purposive from the beginning.

Turn to the absolutism of the minute which has expressed itself in the polemic over "materialism," and finds illustration in a widely diffused attitude towards natural objects. When people look up at the moon it is for the most of them merely a shining, disc-like body suspended in the sky. How few realize it is an object, not disc-like, but spherical, not motionless, but moving at high speed — a combination of massiveness, solidity and form held in flight and changing its place from instant to instant.

Our ordinary conception of the earth is that of a firm surface to walk on: even those who know of its motions do not habitually vizualize it as revolving on its axis and moving simultaneously in its orbit round the sun. So also is it with plants, animals, human beings — they are dealt with in our everyday mental processes as particular forms, summed up as so many outward appearances, without any regard to or realization of the wonderful processes that go on within them. How much of our knowledge, apart from the sympathy of the poet or the "empathy" of the estheticist, do we read into the phenomena of growth, into the flow of the waters, into the movements of wind and cloud? Of matter we usually take an obstinately absolute view. It is something hard and inert, represented by the fragments that fly off from brick or stone when these are struck — entities which exist of themselves without relation to anything else, which move or change only as pushed or pulled, crushed or riven, which have no active energy save as it is imparted to them from without. It is this idea of matter which most of us have when the physicist tells us of the invisible material ultimates that unite to form visible material aggregates, and it is this idea of it which has given matter the ill-repute which it bears in the disparagement of so-called materialism. But this disparagement, like materialism itself, is mainly based on the absolutist view which both the "materialist" and his critic take of matter: each fails of any adequate appreciation of the power units which they so name. Lifted from its original ether state to be whirled in electrotonic orbits and take part in active chemical combinations, the ultimate unit of matter is in no sense "inert": stress-receiving, stress-exerting, it is linked constitutively with the ether units as an integral and contributing part of the power system which impels to change and makes for endurance. We conceive basely of matter when, by isolating it into particularities, we cut it off from the universe; we conceive worthily of it when we recognize that, within all outward inertness of form, beneath all passivity of aspect, the minutest conceivable fragment of a material aggregate is also playing its dynamic part in the total system of power and in the vast process of cosmic self-maintenance.

Let us not be misled by the naïve supposition that if life be a dynamic process it should be mechanically automatic and nothing more, making it possible to sum up the organism as a series of actions and reactions as rigidly physical in their character as the play and re-play of a leaf moved by the wind. We have here to see how the living body, through a power system, is finally able in the higher stages of vitality, to control, limit, even in a sense to transcend its own physical make-up. The story of advance in the organic world is the story of progress from an indefinite and less developed to a definite and more developed grip by the whole system on its parts, its internal processes and its relational activities. As long as the living system is simple — little more than a congeries of physiological units endowed with the function of self-maintenance in its most generalized form, action passing from unit to unit throughout the system amply suffices for the carrying on of that function. But when specialized organs arise for specialized activities, each spatially separated from the rest, the simpler kind of joint action due to interdependence — of action from whole to part through the units everywhere in contact — needs supplementing. Processes operating separately must be coördinated with each other to the end that no process shall go its own way without regard to what self-maintenance requires from the other processes. The nervous system is developed largely to secure this kind of regulation; there are also within the organism, called forth by the same needs, certain chemical substances — the enzymes and the secretions of various ductless glands — whose work is to slow down some activities or accelerate others. "Chemical messengers," these agents have been called: they are produced and sent out by the total system, and in resorting to them the organism may be said to transcend itself.

What the living body is in the now and the here does not suffice for an explanation of its activities. At the outset its actions and reactions are largely centered in the present — as mere tropisms based on more or less of an inherited mechanism or response. As long as this response is holophrastic, dictated by class tendencies in which the details of each class are ignored in favor of their most general features, the organism never gets far above the plane of instinct. But when nicer and constantly varying adjustments becomes necessary, reaching to the class details, there is more and more resort to past experiences. Active memory, as distinguished from mere inheritance, comes in as one of the controlling factors. The organism reacts less and less as a system living only in the here and now, more and more as a time-and-space whole. The past as experienced, the future as projected, help to determine behavior which else might be submerged in the absolutism of the present. In another way also, as a system in the now and here, the living body transcends itself. Physically related to, more or less dependent upon, the animate forms among which and through which it has arisen, the organism receives from its species furtherances and inhibitions which it could never experience as isolated and single. Viewed only in the present, the physical interchanges required for the perpetuation of life seem no more than a union of one individual with another; viewed as a time-and-space process, they constitute a veritable panmixia which makes each member of a species interdependent with all its members. And the higher we range in life the larger is the scope of this supplementation of unit by system. The lower organism comes into the community of its kind almost ready-made; the human organism, educated and socialized, enters his society almost re-made.

Man is not to be summed up as individual body and organs, function and process: he receives reinforcement from his society and is subject to its control; he shares in the vast stores of experience and knowledge which have been accumulated by his race. Wielding his larger self, he can reach out into those realms of abstract thought which, though they arise out of the function of self-maintenance, have no immediately obvious utility for it; he surveys life as if superior to life, and may pronounce it good or evil, according to his mood — can even join the pessimists who pronounce this the worst of all possible worlds and would have advised Deity differently had they been present at its creation. Transcending his smaller self, he becomes capable of sacrifices which no completely self-centered organism could make, and acquires a power of working towards the realization of ideals which no mere struggle for individual well-being could ever confer. Beyond his bodily and personal needs he responds to the summons of the family relations and, higher than these, to the sway of the civic relations: he is ready to give his life for his country and will die, if need be, for what he conceives to be the truth.

It is only in the absolute view that there seems inconsistency between the character of the organism as a self-maintainer and its character as a self-director — between its subjection to a purely physical process and its power, within limits, to transcend that process. Envisaged as part of a larger process which recruits as well as inhibits, enlarges as well as restricts, man needs no independently imposed psychical or spiritual factor to turn him into paths not demanded by the organic nature which is his. Human behavior is the product, not of a part of the conditions, but of the whole of them. It is just as normal, natural and necessary that man should "transcend himself " as it is necessary, natural and normal that the organic cell should transcend the bare properties of the chemical molecules of which it is composed. And this power to rise above that which is given, that which seems, that which is " now " and " here," gets its highest development in the outlook of him who has overcome absolutism. He it is who, completely illuminated by knowledge, comprehends the system in which he lives, the race and himself included, not as a congeries of present existences, not as a collection of absolutes active in their own right, going their own way, but as a body of time-and-space wholes, of objects interrelated, interdetermining, system-sourced rather than self-sourced. To him is given the power to see beneath each nature event and each human action the universe process out of which they came; to recognize the inevitableness of everything that happens even while he presses on to the something new or the something better; to refrain from expecting more from the conditions than they can yield; to understand the wrong while striving for the right; to resist absorption in the " crowd " and yet to coöperate with his society; to avoid the folly of regarding human conduct as spontaneous and the equal folly of regarding it as non-modifiable.

PART V

RECAPITULATION AND AMPLIFICATION

CHAPTER XLVII

TELEOLOGIES OLD AND NEW

THE simplest view of purposiveness, relieved of every complication and suited to the average mind of all ages, is that offered in the book of Genesis, according to which God, by an act of creative will, called light into being, fashioned the earth and stars, gave rise on this planet to all manner of living creatures, and finally made man " in our image, after our likeness." Here was a conception which assumed omnipotence without assuring omnipresence; vaguely or clearly, moreover, it involved either the thought of creation out of nothing or that of independent existence in the things " created." But as men grew away from anthropomorphism the Almighty came to be regarded as coextensive with the universe, now as identical with things, or again as pervading them with the attributes of life, soul and mind. Philosophical forms of pantheism have been in evidence from the earliest times. The process by which man projects consciousness into the universe is seen already in Plato's " absolute idea," identified by him with God, and in his " world of ideas," of which he regarded the world of sense as no more than a copy. From the thought of the Stoics, who held that the universe is " a living being of which God is the soul, the governing intelligence, the sovereign law and the animating principle," it is not a far cry to Bruno's assertion of a " universal intelligence " or " indwelling reason " in Nature. Hegel (" The Philosophy of History," Introduction) calls reason " the substance of the universe " and

" its infinite energy," describing it further as " the infinite complex of things, their entire essence and truth "; and Fechner's " Über die Seelenfrage," devoted to the thesis that plants, the earth and the stars have souls, culminates in the statement (p. 223): " God is the All, or the soul of the All, according as one wishes to understand it." Typical of many modern conceptions of divine immanence is Isaac Newton's belief (" Opticks ") that the various portions of the world, organic and inorganic, " can be the effect of nothing else than the wisdom and skill of a powerful, ever-living Agent who, being in all places, is more able by his own will to move the bodies within his boundless uniform sensorium, and thereby to form and re-form the parts of the universe, than we are by our own will to move the parts of our own bodies." Nearly two centuries later Theodore Parker refashioned this definition in the words: " God, then, is universally present in the world of matter. He is the substantiality of matter . . . he fills all Nature with his overflowing currents; without him it were not. His presence gives it existence; his will its law and force; his wisdom its order; his goodness its beauty." Josiah Royce also sought to show " the whole universe, including the physical universe also, as essentially a living thing, a mind, one Great Spirit." And Lyman Abbott wrote in " The Theology of an Evolutionist ": " I believe that the theology of the future will affirm that this Infinite and Eternal Energy is itself intelligent and beneficent — an infinitely wise and holy Spirit dwelling within the universe and shaping it from within, much as the human spirit dwells within the human body and forms and controls it from within."

Between the earliest conceptions of a Deity external to the world and the new teachings of his immanence human thought has furnished teleologies of such protean forms as to make classification of them well-nigh impossible. Some of these take Deity for granted, others posit a " world soul"; all seek to interpret the appearances of "design in nature." The Greek hylozoists were convinced that matter has an original life-principle which shows itself in both inorganic and organic; by Anaxagoras the purposiveness revealed in things is referred to an ordering spirit or *nous;* Empedocles was content to trace their movements to love as uniter and to hate as divider. When the idea of the *nous* as cause and orderer of things was presented to Socrates he commented: "If this be so, then the mind of the orderer will dispose of all things and place each individual thing in such a way as shall be for the best." Plato, his disciple, pictured a world of ends in which the "divine Architect" successively realizes his purpose through the plastic action of the Idea, the absolute good, against the obstructive opposition of matter. Aristotle adopted the conception of the divine *nous,* attributed life to a "creative purpose," and in his doctrine of the "entelechy" asserted that "organisms differ from inorganic bodies in that they are impelled by an internal principle, a *psyche,* which employs a number of organs to realize its purposes." To both organic and inorganic Hegel applied the formula of a "plastic instinct," an unconscious purposive activity (*bewusstlose Zweckthätigkeit*), which "acts without consciousness with a view to an end"; Hartmann held that matter consists of an inseparable unity of will and idea, and that atoms must be conceived of as wills or efforts, as having "an unconscious idea" of their destiny in order to be able to realize it. Kant, while believing that mechanism fully explains the inorganic world, recognized the need of a teleological view in the consideration of anatomy, physiology and biology. He also wrote: "It is impossible to find in Nature grounds for an explanation of Nature, and we are compelled by the constitution of our intellectual faculty to seek for the supreme ground of teleological connection in an original intelligence as cause of the world."

Modern assertions of an intelligent principle at work in the universe shade off into assertions of purposiveness in the organism: in neither application is there any real attempt to meet the problem with a solution. The so-called definitions of life have descriptive, but no explanatory value. How are vital processes elucidated by Bichat's "sum total of the forces that resist death," Béclard's "organization in action," by De Blainville's "two-fold movement of composition, at once general and continuous," or by G. H. Lewes's "series of definite and successive changes, both of structure and composition, which take place within an individual without destroying its identity"? Nor is explanation furthered by reversion to such vague conceptions as the "physis" of Hippocrates, the "archaeus maximus" of Paracelsus, the "Bildungstrieb" or "nisus-formativus of Blumenbach, Johann Mueller's "organic force," Cudworth's "plastic nature," Hegel's *Trieb der Perfectibilität,* Robinet's *idée génératrice,* Virchow's "inner necessity," Nägeli's *Vervollkommnungsprinzip* or "tendency to progressive development," Bischoff's "peculiar and individual cause or force which creates and shapes the whole body," the "genetic energy" of Williams, Henslow's "property of self-adaptation," or Moore's "bathmic energy." Just as unavailing is Lester F. Ward's effort to explain vital characters from the advance in complexity which matter makes by becoming organic. "From the molecule of hydrogen to that of albumen," he writes ("The Status of the Mind Problem"), "the process of evolution has been uniformly the same, viz., that of compounding and recompounding, of doubly and multiply compounding; in short, it has been the process of molecular aggregation, with still higher states of aggregation; therefore we should naturally expect still higher forms of activity, still more marked properties." He is more explicit still, adding: "The general truth is that chemical union results in a new substance with new properties, differing from and of a higher order than those of any which have united to produce it. When the highest known chemical compounds still further combine we ought therefore to look for something remarkable. Where the largest molecules whose constitution can be determined in a laboratory form themselves into higher molecular systems, we should not be surprised if the resultant substance should be an exceedingly strange and important one. The activities of all substances up to this point are molecular, but it might well be that the new compound should possess molar activities." This is plainly an arithmetical or multiplication-table theory of vital phenomena. It means that you have only to go on compounding and re-compounding inorganic units to see life finally emerge. It implies also the wonderful things which might happen were the complexity to be still further increased.

F. A. Lange, in his "Geschichte des Materialismus" (p. 581), writes of "the mystical domination of the part by the whole" with the remark that "little can be done with that." The vitalists have tried to do much with it, and vitalism has had a long history, with distinctions only loosely maintained between the notion of a psychical principle in the organism and that of a "vital force" totally unlike force in the inorganic. It was the "vital" kind of force which Claude Bernard called "creative": "*Ce qui est essentiellement du domaine de la vie, et ce qui n'appartient ni à la physique, ni à la chimie, ni à rien autre chose, c'est l'idée directrice de cette évolution vitale.*" Schopenhauer, who projected "will" into Nature, tells us in his "Parerga und Paralipomena" that the denial of vital force is absurd: "It is not disputed that physical and chemical forces are at work in the organism, but that which holds them together and guides them, so that the organism comes into being and subsists, that is vital force." For Lionel Beale ("Protoplasm") life is "a peculiar force temporarily associated with matter," a "power capable of directing and controlling both matter and force," "an undiscovered form of force having no connection with primary energy or motion," "some directing agency of a kind peculiar to the living world." By Hans Driesch ("The History and Theory of Vitalism") a return is made to the "entelechy," described as "an agent *sui generis,* non-material and non-spatial, but acting 'into' space, so to speak," also as a "psychoid" or kind of potentiality or power not present in inorganic bodies. But the inconsistencies and contradictions of vitalism find their completest representation in Henri Bergson ("Creative Evolution"), who reads psychism into Nature with a *naïveté* almost passing belief. For him there are two forms of existence, matter and consciousness, with their origin traceable to some common source — matter defined as a "reversal" of consciousness, a thing that "continually unmakes itself and wears out"; consciousness described as "action that continually creates and multiplies." It is asserted that there is a "universal life" with which "consciousness must be coextensive," and that life appears by the action of consciousness upon "inert matter," life being defined as "consciousness launched into matter"; for wherever vital characters show themselves "it is as if a broad current of consciousness had penetrated matter" and "carried matter along to organization." Life is "like a current passing from germ to germ through the medium of a developed organism"; there is "an original impetus, an internal push, that has carried life, by more and more complex forms, to higher and higher destinies." More specifically, we are assured that "at a certain point of space a visible current has taken rise; this current of life, traversing the bodies it has organized one after another, has become divided amongst species and distributed amongst individuals without losing anything of its force, rather intensifying in proportion to its advance." Bergson rejects what he calls "both radical mechanism and radical finalism," asserting that his philosophy, "like radical finalism, though in a vaguer form," represents the organized world as a harmonious whole. But beyond these highly generalized statements, which assume without elucidation of them the very modes of action to be explained, he makes no approach to a teleology that can be reconciled with the deliverances of science, with modern Nature knowledge, or with the requirements of that common sense which, confronted with any machine-like apparatus realizing ends, insists on knowing "how it works." How it can be true that "there are no things, there are only actions," and at the same time true that there is an "inert matter" to be invaded and carried on to organization is not revealed by the theory. The asserted grip of consciousness on matter, each of them treated as unlike the other by a total difference of kind, is a manifest confusion of psychic with dynamic values. Nor does the notion of a "vital impetus" as the cause of life advance the explanation of purposiveness in the organism by a single stage: to attribute vital phenomena to an *élan vital* is like saying that the organism is alive because it has been vitalized. And the interpretation of reality as "unceasing life, action, freedom," as "a ceaseless upspringing of something new," is a manifest denial of the determinisms and repetitions which are essential to the order we behold in the cosmos, and from which the only freedom possible to us as human beings can flow.

There is an approach to a dynamico-mechanical explanation of evolution in Herbert Spencer's system of thought, but no suggestion of a specific purposiveness in Nature finally attaining to more complex manifestation in life: it is as if the author of "First Principles" were so sure of the utter lack of anything like a teleology in things that — except for a vigorous repudiation of vitalistic hypotheses — he did not even see the necessity of denying its existence. His doctrine of a general world drift towards "equilibration" recalls Fechner's "tendency to stability," yet by neither author is the conception worked out to its "purposive" implications. For Spencer all forms and configurations that arise in the universe are due to the persistence of force, to the transformation of the relatively homogeneous into the relatively heretogeneous, to the multiplication of effects, and to processes of integration and segregation culminating in equilibrium. He describes living aggregates as being "distinguished by the connected facts that during integration they undergo very remarkable secondary changes which other aggregates do not undergo to any considerable extent, and that they contain (bulks being supposed equal) immensely greater quantities of motion locked up in various ways." It is further stated that "all vital actions, considered not separately, but in their *ensemble,* have for their final purpose the balancing of certain outer processes by certain inner processes. There are unceasing external forces tending to bring the matter of which organic bodies consist into that state of stable equilibrium displayed by inorganic bodies; there are internal forces by which this tendency is constantly antagonized; and the perpetual changes which constitute life may be regarded as incidental to the maintenance of the antagonism."

It is here implied in a roundabout way that the organism is engaged in maintaining itself, but when life is to be explained Mr. Spencer contents himself with calling it "the continuous adjustment of internal relations to external relations," thus placing his emphasis on a subordinate detail which has many analogues in inorganic processes and takes no account of the fact that the organism man, to say nothing of the lower animals, has been engaged from the beginning in adjusting external relations to internal relations. How an organic aggregate which differs from one that is inorganic in having " immensely greater quantities of motion locked up in various ways," comes unconsciously to fashion its own organs as man fashions his tools, Mr. Spencer nowhere states. There is a further surrender of the attempt at explanation in the positing of " very complex molecules," forming " an extremely changeable substance," naturally " exposed to those innumerable modifications of conditions which the earth's surface afforded," and yielding under " the mutual influence of its metamorphic forms under favoring conditions . . . the still more sensitive, still more variously changeable portions of organic matter, which, in masses more minute than existing protozoa, displayed actions varying little by little into those called vital." For this view it is because of the molecular instability of organic matter, because its structure becomes more " heterogeneous," because under the stress of incident forces it obeys the law of the " multiplication of effects," not because the system is purposive from the beginning, that by means of successive integrations and differentiations the life functions arise and organs are developed. Empty of both causal and genetic meaning is the passage which defines " the structural complexity accompanying functional equilibration " as " one in which there are as many specialized parts as are capable separately and jointly of counteracting the separate and joint forces amid which the organism exists "; it ignores, moreover, the elementary fact that a large part of the activities of organisms is expended, not merely in " counteracting," but also in utilizing external forces. And though Mr. Spencer comes unwittingly near an important purposive factor in his account of motion as following " the line of greatest traction, or the line of least resistance, or the resultant of the two," his application of the principle is made, not to the process by which organs are originally set up, but only to organic development in general, especially to shapes taken and movements carried on after the organs have been formed.

One of the most recent efforts to explain the teleology of the organism is that of L. T. Hobhouse in " Development and Purpose." Its author fully recognizes the " mutual determination of parts " which " must run through Reality as a whole," and is therefore led " to conceive of Reality either as being a system of parts which necessitate one another or as being a collocation determined by such system " (p. 348). He is explicit also in defining the difference between inorganic and organic bodies, the one class made up of relatively independent units, the other of units dependent on the character of the system. But despite frequent reference to " the requirements of the whole " we get no real recognition of the directing power of the total system from organic beginnings. An " unfinished window " is also left in the account of heredity: " What must exist at the beginning is not the developed structure in miniature, but rather something that will seize on all that comes within its grip and throw it into place in such fashion that bit by bit the structure will grow " (p. 360). There is here no identification of the " something," and no explanation of the actual process of growth. And for the universe at large, as for the organism in particular, Prof. Hobhouse's " purpose " is plainly psychical, based on the consciousness implied in human design; not dynamical, founded in the nature of cosmic power. " The evolutionary process," he writes, " can best be understood as the effect of a purpose slowly working itself out under limiting conditions which it brings successively under control. . . . This would mean, not that Reality is spiritual or the creation of an unconditioned mind . . . but that there is a spiritual element integral to the structure and movement of Reality, and that evolution is the process by which this principle makes itself master of the residual conditions which at first dominate its life and thwart its efforts." And he yet more plainly allies himself with the psychomorphists, first by inferring "a power of the nature of mind operating under conditions towards the effectuation of a world-purpose," then by asserting explicitly that "there is a mind of which the world-purpose is the object," and that "such a mind must be a permanent and central factor in the process of Reality." But "how in detail its relation to Reality in general and the individual mind in particular is to be conceived," he concedes, "is a question about which it is best frankly to confess ignorance!"

Recognition of some kind of purposiveness in Nature is thus an enduring element of human thought. Beginning with the ancients, it has survived the negations of materialism and the fortuities of natural selection; for our own time it recurs again in vitalism and finds distant though distinct reverberation in the biological doctrine of orthogenesis. Yet none of the teleologies or half teleologies of the past, whether religious, philosophical, metaphysical or scientific supply us with the clue which we need. The method followed in the most typical of them is to refer the appearances of "design" to some general entity or principle and use that as the cause of the phenomena to be explained, but without effort to trace its operation step by step through the action to the effect. Many of the "solutions" offered are founded on man's well-nigh ineradicable tendency to read into the universe and its processes the life, will, consciousness or personality — sometimes all these — which he finds in himself. Where the principle invoked is psychic, the theorist sets consciousness, the latest arrival, at the beginning of things, but fails to show how mind can emerge for knowing and directive functions from a power system which is manifestly preorganic; where the appeal is made to a universally diffused will he commits the parallel yet more radical absurdity of positing life in advance of the only conditions which can make life possible. Too often, even in biological hypotheses, organic purposiveness is regarded as a new appearance in Nature, as unlinked with any more elementary purposiveness in the inorganic. A vast amount of current reasoning about evolution proceeds on the assumption that teleological questions, being pertinent only in the realms of metaphysics and religion, can be safely ignored; much recent discussion in biology takes it for granted that the issue of purposiveness in the organism is outside the purview of science. The specialist who studies vital phenomena is mainly concerned with the complications which life displays after it has appeared — with germ-plasm, heredity and the "Mendelian factors"; with details of cell development, with the manner in which the organism adapts itself to changes of environment, with the inheritance or non-inheritance of "acquired characters," and with the multifarious facts which bear on the "origin of species," as if none of the conclusions in these fields needed the buttressing of some radical insight into the meaning of life itself. And philosophy, which should realize that purposiveness is the fundamental problem in all nature study, busies itself more and more in the superstructure, lavishing its powers on the theory of knowledge, on the relation between mind and body, and on such subtopics as pluralism, pragmatism and neo-realism. Needful as is work in these fields, it should not surprise that some of our modern teleologies are seen raising subjectivism to the *n*th power or succeeding only as contributions to the romance of metaphysics.

CHAPTER XLVIII

GAINS OF THE NEW VIEW

The road thus far traveled, along a track not much frequented, has given us a satisfying glimpse of that unity towards the better realization of which we have so long aspired. Far yet from being scaled is the peak of Nature knowledge, yet we have advanced sufficiently towards its summit to recognize that the landscape which once greeted us below as an assemblage of disconnected fragments, here fitfully glimpsed, there wholly hidden, is a continuous panorama, in the intellectual outlook upon which all former prospects melt into one. The old view of a world of matter and empty space, by making the unit self-dependent, relegated "inertia" to the realm of mystery and rendered the problem of motion, of its nature and origin, irresolvable. With the matter unit regarded as self-sourced rather than as system-sourced, it was impossible to recognize community between the power by which things exist and the power by which they move. Unable to refer the continuing of the material ultimate to the continuing of the power system, the mind failed to relate self-maintenance in the organism to self-maintenance in the universe; with a like inevitableness, due to the absolute view, intelligence had to be regarded as a something superadded to matter, or as a merely organic manifestation, instead of as a cosmic principle rooted in the very nature of things.

In the relational view, which no longer hypostatizes the extension of objects into a capacity for "containing" them, the characters of matter derive from the more universal characters of power itself. The cosmos is certainly seen, as in the ancient view, to be made up of units, but these are recognized as continuous, interdependent, interdetermining — interrelated, that is to say, not adventitiously as self-sourced, but constitutively as system-sourced. Finding stress and restress to be the essential nature of power, we are led to envisage the cosmos accessible to us as made up of equivalent parts of minimum area, striving and being striven against in a dynamic antagonism which is contributed by unit to system and refluent from system to unit, the unit everywhere subordinated, the system everywhere dominating. From this conception of the universe there follows the view of power not as "persisting" or as "conserved," but as two-sided and therefore as engaged in self-maintenance. It is this view of cosmic self-maintenance, involving that of the two-sided nature of power, which enables us to relate motion to the system through which it is produced, to regard kinetic energy, so-called, as the secondary form of primordial or ether energy, and therefore to connect change everywhere with the general function of the cosmos.

In the realm of power, as we have seen, the equivalence demanded for self-maintenance is preserved without motion; in the realm of matter, motions of collocation and re-collocation are needed to set up the equalized stresses which represent enduring and therefore "intelligent" forms. In the associative aspect of the process the cosmos is seen thrusting matter units away from itself, if within itself, on the ground of their superficial unlikeness to the ether, and simultaneously towards each other on the ground of their fundamental likeness to one another. In the distributive aspect the universe is active in diffusing through its area motion locally accumulated and matter units loosed from local bonds — in preserving the power system from the distortions arising out of unequal distribution, in setting up, as far as may be, but only so far as may be, what may be called like conditions for like areas. If the cosmic insistence on likeness could succeed completely there would be immobility, quiescence, stagnation; if the drift towards difference could completely triumph, chaos would be the outcome. What we see is a universe of power first differentiating itself into material unlikenesses that represent conditions of differential stress, then impelling its products into the configurations which represent equalized stress: as the homogeneous sea strives with the unquiet waves that ruffle its bosom, so the homogeneous power system works incessantly to equilibrate the superficially unlike dynamic values that arise within it — strives in a word, towards end, the end of self-maintenance. In this way is brought out — it is believed for the first time, — the tremendous importance of what may be called the fundamental categories of likeness and difference. To a universe of striving difference is essential; in a universe which is to achieve, likeness is fundamental. In its most general aspect evolution is a movement in which the cosmos, giving rise to difference, insists on likeness — toils, in a word, towards self-recovery, from the differentiations that have arisen within it, and thus gives origin to the collectivizations that resemble itself in the sense that all of them are systems illustrating the relation of whole and part, and that for all of them, here passively attained, there actively striven for, endurance is the end and goal. Collectivization of like parts takes place in all material substances; it shows itself in the physiological units despite differences due to function; in looser form it is seen in the associated membership of every species; it is the basic fact of mental activities. Classes of inorganic substances are classes because their units resemble each other; the members of a species, omitting slight individual peculiarities, correspond so closely in structure that were matter penetrable a " composite " organism is conceivable which would engulf them all. The lot that is meted out by the universe to its differentiated parts thus follows the law of the universe as a whole: material systems, whether inorganic or organic, are fashioned in the likeness of the cosmos.

The whole course of cosmic evolution, so far as matter is concerned, is thus seen to be an advance, roughly speaking, from the absolute to the related. The less collectivized things are the less purposiveness shows itself; the more completely relation is established the more is purposiveness evident. Out of material units largely "going their own way" the universe makes systems of parts dominated by the wholes they form, and such systems, at first more or less absolutes, tend to become interdependent. There is a difference of degree only, not of kind, between the relations set up between atoms in the molecule and the relations established between the planets of a solar system. The gradual collectivization of cells into a unified organism, of plant and animal organisms into a species, of individual men, first into tribes, finally into nations, is all along a perfecting of the relations through which the units come to be more or less determined by their systems: as this process is illustrated in the individual organism by the neural and other links which unify it, so is it illustrated by the numberless agencies and instructed mentalities through which species, communities and peoples come into closer relations with each other. Progress in the evolution of thought is an advance in the power of mind to relate its materials; progress in the yield, scope and validity of knowledge involves advance in the capacity for taking many things into account as a means to the comprehension of each. The classification of objects as likes and unlikes is the simplest form of the process; the modern "comparative" method, essential in the study of particular languages, literatures and religions, as well as the recognized need for the specialist in any given science to know something of other sciences, tells eloquently for the view that advance in knowledge is advance in the grasp of those relations which exist independently of knowledge.

Meanwhile there are many loopholes of absolutism in the cosmic drift towards relation. Star systems in course of formation are subject to disturbance; the comets that may visit us are not all listed, and it is impossible to predict the fall of meteors as we predict eclipses of sun and moon. How far have we progressed in forecasting wind and weather? The species of plants hold themselves organically apart, " correlated " in a sense as they may have become to environments both animate and inanimate; within his nationalist confines, despite much advance towards interdependence and unification, man himself is yet far from being fully related to his kind. There is an obvious absolutism in the anti-social attitude of the individual who fails in duty to his community; there is a not yet fully recognized absolutism in the nation which fails in its duty to the world. For human beings in the mass a people is intelligible with little or no knowledge of other peoples, and dealings with one's own can be carried on with little or no help from history. Not yet is an acquaintance with sociology regarded as essential for success in either legislation or political leadership. By the " average man " as well as by the specialist, things and events are still judged in fragments or aspects, instead of as wholes: each selects the one or other of them best suited to his interests, disregarding the rest. For absolutists of every type and class the world exists mainly in the " here " and the " now," with its objects treated as self-sourced rather than as system-sourced. But the urge towards relation and towards the recognition of it continues to be an ever-operative factor in the mind and in the objects which it contemplates. However imperfectly realized, the relating process is revealed, in its weakness as in its strength, at once by the things known and by the ways in which we know them.

In this way the relational view, looking beyond the thought of separable processes of aggregation and diffusion, and beneath the conception of "correlated forces" adventitiously related to each other, to that unity of power in which all processes have their origin, does something more than place the coming and going of matter under the direct ordering of the cosmos. It explains and universalizes "intelligent adaptations" by rooting so-called "intelligence," not in consciousness, but in the very nature of two-sided and self-maintaining power; it links the complex teleology of the organic with the simple, elementary, yet no less definite teleology of the pre-organic, and does this by identifying teleology, shown to be in its deepest nature dynamic, with the imposed necessity of maintenance, and with the manner in which, given the motion process, maintenance can alone be realized. For in a universe of divisionalized power, where likeness means endurance and unlikeness change; where the setting up of equivalent dynamic values is the unconscious goal of all motion; uneconomical, unharmonious, unteleological forms, representing conditions of differential stress, are most exposed to elimination, just as economical, harmonious and teleological forms, embodying conditions of equalized stress, are the forms best fitted to endure. Adaptations in the inorganic, in living bodies, in human societies and in the mind of man are all of them, without exception, the conditions of maintenance understood, products and illustrations of the cosmic process. And it is this inevitable domination of the unit by the system, this inevitable progress of matter away from conditions of motion, form, size and position which involve the maximum of collision, friction, disturbance and waste towards conditions of minimum collision, friction, disturbance and waste, which constitutes the teleology of organism and cosmos alike.

Purposiveness thus substitutes the illumination of a definite and purely dynamic process for the so-called striving after end vaguely claimed for organic nature in the *Zielstrebigkeit* of Von Baer. Fortuity, reigning supreme in the thought of Democritus and the atomists, attaining to more or less of expression in the modern theory of natural selection, is here transformed in character and relegated to a subordinate part in the world order. From the elementary symbolism of a universe needing to be supplemented we are released by the conception of a self-complicating, yet also of a self-ordering cosmos sufficient unto itself. For a world of accident out of whose clashing forces and struggling units an appearance of harmony somehow or other blindly emerges, the relational view substitutes a world of definite tendency wherein the goal of the conflict and the striving is prefigured from the beginning. The real ground of the similarity between teleological forms in inorganic and organic is seen to be, neither consciously originated plan imposed upon nature, as in the theological view, nor yet an elementary conscious intelligence within nature, as in an occasionally held scientific view — neither a consciously acting world soul ordering "intractable" matter from without, nor a conscious will, however incipient, animating each unit of that matter — but the dynamic purposiveness which manifests itself in the common impulsion of all material activities and forms away from conditions of differential stress towards conditions of equalized stress. Power is here regarded, not as an aggregated multiplicity, but as a divisionalized unity. Its differentiation into material units makes groupings, collocations, moving systems and configurations of them possible. The impulsion of the cosmic system to self-maintenance, its conversion of differential stress through motion into equalized stresses, result in the arrangements we call intelligent adaptations. The "end" of maintenance, of endurance, is implicit in the nature of the system, whether inorganic or organic; it finds realization through the displacements and replacements which the system imposes. Contrivance or design in nature is the elementary form of the end-reaching we witness and practise in our own lives as organisms. Out of a process which has endurance for its goal emerges in both living and not-living the intelligence of "intelligent adaptations." In accepting this view we deliver purposiveness in Nature from its supposed origin in psychic elements; the notion of a cosmos ruled by mind widens out into the thought of a cosmos potential of mind, as well as of possibilities unutterably beyond the grasp of mind; the appeal to the argument from design yields to the argument from the nature of power. Purposiveness in life is meanwhile emancipated from both vitalistic and mechanistic assumptions — from the crude symbolism of the one, from the narrow empiricism of the other. The organism is under determination: in all its acting and developing the cause-effect relation may be traced. But as a self-maintainer it is none the less relatively self-centered, self-acting, autonomous. The physico-chemical properties of matter are servants, not masters in the house of life. The determinism is that of a system that wields itself. The freedom involved is that of organic causation.

The cosmic flux, like the organic flux, must be regarded as a means to endurance. Change is eternal, but things flow and continue to flow in the same general way, in modes that can be relied on and predicted: the vicissitudes succeed each other, their order remains. There are plenty of unteleological conflicts in nature, yet the emergence of enduring form — there as suns, planets and their furnishings, here as the crowded display of the organic world — shows beyond peradventure a final triumph of the collectivizing over the dissipating, the purposive over the fortuitous tendencies. As motion in the inorganic ensures the conservation of power, so changes in the organism are means to self-maintenance. The functions of life in the moneron and in man do not essentially differ; the class frameworks remain throughout organic ascent — it is only their content which undergoes multiplication and enrichment. In human activities, in tools and machines, even in social and political systems, men work towards the things which endure. Speech is a body of signs whose general character survives all changes; human thought, through whatsoever vicissitudes and controversies, keeps its fundamental elements unmodified. There is an inertia of mind as well as of matter, a conservation of ideas as well as of energy. The drift of science is towards a body of truths that shall endure; sure foothold in their own affirmations is also the quest of the theologians. The world's great thinkers still "beacon from the abode where the eternal are." Insistence on the flow of things is thus only half the story. All material objects are time-and-space wholes: only as such, and as arising out of the cosmic whole, can we have reliable knowledge of them. To sum them up as present existences in time or as local existences in space is to cut them off from the universe. Even if we could isolate the flow from the things that flow, we should need to take account of its direction and end. Only by realizing the flux as teleological, as a working towards intelligent forms, do we grasp the meaning of change, and to that extent the meaning of reality. The changes that seem to expend power do but insure its continuance. The power that changes not survives all change as the very possibility of change. Malherbe wrote more wisely than he knew when he declared that "nothing endures eternally, in order that all may endure." "*Et rien, afin que tout dure, ne dure éternellement.*"

Yet in rejecting the ancient thought of conscious design in Nature for the conception of an omnipresent primordial intelligence identical with things, we must not fail to recognize the provisional value of the earlier view: it was inevitable for the human mind to regard the organic process and the universe process as somehow fundamentally one. In now reversing the order in which cosmic purposiveness is referred to consciousness and will, after the analogy of human purposiveness, the relational view at once gives a quasi sanction to the earlier nature symbolisms, and negatives the opinion, by no means confined to "materialists," that an inorganic process conceived of dynamically would preclude man from all sympathy with it, doing this by revealing a bond between cosmic striving and human aspirations that transforms Nature before our eyes. Inaccessible and uncomprehended in its depths as the universe must be, we none the less envisage the ever-regnant, ever-active and unescapable power, without a shadow of turning, which in one guise or another, over-symbolized here, inadequately realized there — now split up into separate potencies, and again conceived of as unity — which human beings have never ceased to hold in their hearts and minds as the Almighty. Rejecting at once the atheism which denies teleology in Nature and the pantheism that identifies creative power with the realm of merely material things, the new view supersedes alike the materialism in which phenomena are traced to matter pushed and pulled and the spiritualism that divides the universe into differing and independent powers. Pluralism and monism are reconciled in the thought of a cosmos which is not the bare sum of its aggregated individualities, but a potency gathered from all and shared in by each — not a totality of parts adventitiously co-existing, but a whole of units interdependent, interdetermining and thus self-maintained. Nor does the moral fatalism of an imperfectly realized cosmic unity survive the passing of the absolute attitude towards Nature, since if the vastness of the numbers engaged everywhere arrays the many against the one, the ideal equity and supreme reasonableness of the world is none the less revealed in a relation that lifts the littleness of things to the dignity of a just part in the power that guides and marshals them, the while that it confers the task of fashioning each upon the assembled potencies of all.

In the relational view most of the problems which have perplexed students of Nature and of life lose their whilom insolubility or fall wholly away. The controversy regarding " free will " passes when it is realized that life is itself a liberation from the dynamical rigidities and necessities of the pre-vital world, that freedom is not anarchical spontaneity, but a freedom under determination, and that for us, at least, the highest form of this organic liberty is reached when the cosmic process culminates in man. So vanishes also the reproach founded on the so-called "problem of evil," for that can be justified only so long as, by retaining anthropomorphic, biomorphic and psychomorphic conceptions of universe power, we read into Deity our own kinds of behavior and hold Deity to our own standards of responsibility. It is an emancipation to recognize that there is no " nature of things " which might have been otherwise contrived, and no division between things and the power which, linked in some way with an inaccessible super-real, is regnant in all they are and do. Many of the doubts which perplex us in skeptical moods arise because the universe is not always going our way; much of the evil we deplore is evil for us, not for the cosmos. Nature is precise; her ways are unyielding. Her decree is that things shall act and react, shall suffer and enjoy, according to their character and place in the system, according to the conditions amid which they exist. Despite end to be attained, there is a rigid and, from the human point of view, a merciless enforcement of what is against the what has been and against the what ought to be. Our own human ideals of equity look back to consciously exerted purpose and forward to justice realized. Nature's dower, once bestowed, has the all-dominating cosmos on its side. No consideration for human values dilutes poison in the veins or arrests the avalanche in its course; the wayfarer expects no apology for the lightning stroke that lays him low; in the rigors of an arctic winter the heroic explorer dies unpitied. To the faintest quiver of an electron, to the swiftest march of a sun, the universe acts itself out. Yet it is only on that foundation, differentiating unconscious purposiveness from conscious, that our own forecasts, preferences, plannings and strivings become possible. Put into inorganic nature will and feeling, deliberation and choice, tenderness and compassion, and the supporting fabric out of which all these arise disappears.

It has been held that man's deepest longings are satisfied, that his deepest needs find response, only through direct personal relations with the Almighty. We have the beginnings of such relations in the whole inorganic universe, shot through and through as it is with the intelligence which is the source of ours; a higher form of them is yielded wherever that intelligence has emerged into life; they are ours in the highest degree among our fellow men and in the human community whereof we are members. Prayer itself, suggesting the possibility of a personal appeal, may be founded on the degree to which, in subtle ways, perhaps sub-consciously, the wishes and aspirations of the individual facilitate response from his social environment. Meanwhile the scope for wonder, gratitude, reverence, is not lessened, but enlarged by the widening of our cosmic outlook; and should the hope of yet other horizons lure us towards conditions utterly unlike any we know as mortals, the ground of it is hidden there beneath the show of things in the super-nature, and not less profoundly in the depths of our own conscious selves.

How far, finally, do we see into the universe plan? The ant whose hill was shot away by a shell in France knew nothing of the great issues of the war; from the bird killed for its plumage, the seal taken for its skin, the aims and ways of commerce are hidden; to the dog caring for his master's sheep, to the horse harnessed to the work of man, no glimpse or glimmering of the complexities of human civilization is vouchsafed. Must not the universe be vastly richer than anything we can know about it, and are we not, in our attempt to sum it up in concepts and propositions, simply dealing with its surface inscriptions, — busying ourselves, as Rückert suggested, with luminous figures on some vast curtain that does but conceal the realities which it seems to body forth? And may not his reserve, as well as his reverence, also be ours?

Ich neige mich zum tiefsten Saume,
Und küss ihn nur mit Beben;
Mir fällt nicht ein im kühnsten Traume
Den Vorhang wegzuheben.

CHAPTER XLIX

THE WAY OUT OF SUBJECTIVISM

The serious troubles of thought about Nature are troubles of subjectivism, and most of them, like subjectivism itself, come of dealing with the one apart from the many, treating each object as complete in itself, viewing the natural process as self-sourced instead of as system-sourced. Willing to accept a few relations as adequate to a problem which requires for its solution all relations man fondly lingers in anthropomorphism, or naïvely returns to it in biomorphism and psychomorphism. And the modern neglect to unify the living organism with the cosmos, to realize life as a derivative form of universe self-maintenance, to envisage consciousness, knowledge, mind, as ancillary to life, instead of as its driving power, is of a piece with the primitive ignorance, the intellectual sloth, which deduced the shape of the earth from the flat area of it that could be seen, and in the apparent circling of sun, moon and stars found the evidence of a daily revolution of the heavens. All methods of ensouling nature, gross and refined, got themselves rooted in human thought in the days ere men had begun to conceive of things as physically interconnected, interdependent, interdetermining. Real existence was of objects which could be seen, felt or manipulated. The invisible air functioned as a ghost, and that only when it moved; the ether, at once intangible and invisible, was the equivalent of nothing. Even down to a comparatively recent period the universe, now treated as a tense dynamic continuum, was regarded as a mere containing vacuum for objects — an ocean of nothingness in which material aggregates rested or moved in single solitariness. Hence came the idea of the organism as existing of its own right — not as receiving its attributes from Nature, but as entitled to impose its own attributes upon Nature. Man in the new view, however self-active, arises out of the universe process, is subordinated thereto, and must interpret it in terms of part and whole; man in the old view had been mysteriously superposed upon the cosmos, was the autonomous wielder of a system of knowledge unrelated to things, and could freely dictate interpretations of them from his own feelings, consciousness and thought.

Any worthy view of the cosmos process requires us to reverse the procedure of subjectivism by using for the interpretation of Nature not the superficial characters of life, but rather the fundamental characters of universe power. In causally relating the organism to its source by recognizing the deeper modes common to both we subsume a system whose divisionalization into units makes it a many, whose constitutive, reciprocally involved antagonisms, needing and insisting on each other, make it a one; a universe where change arises from the eternal production of difference and the eternal struggle to restore likeness; a cosmos in which strife is the primordial form of coöperation, determination the condition of freedom, individual being the outcome of delegated power. Emancipated from the thought of a world dominated by fortuity, we grow into the thought of a world in which chance is unceasingly subordinated to direction. Finding the origins of the purposive in the dynamic, we acquire a grander and worthier sense of what plan in Nature really means than any suggested by the old argument from design. Rejecting the anthropomorphic view of a cosmos not sufficient unto itself and needing to be supplemented, we put in its place the thought of a self-sufficing process through which universe intelligence, organic intelligence and human intelligence find their unity and explanation. Vital phenomena are meanwhile relieved from that implication of rigid fatalism in which merely mechanical theories have shrouded them. We are no longer compelled to regard life as a mere "continuous adjustment of internal relations to external relations," or as a purely physico-chemical process in which the immediate environment is of equal importance with the organism which it enfolds. Under a higher form of determination we see matter lifted above inorganic reals into a realm of quasi-spontaneity where power may indeed separate itself from the direction of power, but where freedom and determination, instead of excluding each other, coalesce.

If the universe be one in all its modes; if intelligence be dynamic before it is consciously purposive, and consciously purposive only because it is first dynamic — science should have no need to coquet with the anthropomorphisms. Its way out is not through the morass of subjectivism, but is rather to be sought along that broad highroad of physical interpretation which it has followed so long and so successfully. With a larger view of the resources of the universe in our minds, the teleology of both inorganic and organic will submit itself more fully and less mysteriously to human comprehension; with a deeper recognition of the resources of the organism in our theories, there will be borne in upon us the supreme naturalness of the self-activities, protective as well as renewing, by which the living system maintains itself. It will be ours to turn to the modes of power, rather than to modes of consciousness, for the meaning of intelligence, and to Nature's own planning for an explanation of the purposive in man — ours also to realize that every contrivance needed by the organism in the interest of life, even the most complicated and wonderful, is there latent as the statue is latent in the block of marble, and that the magic which calls it forth is just the physical potencies of matter plus organic conditions and organic causation, with the whole rich universe behind them as their source and support. For beyond life, thus originated and buttressed, we envisage the cosmic one, dowering the organism, created in its own image, with the capacity for carrying on the business of self-maintenance for itself; the cosmic many, whose vast tides, however crossed or delayed by eddies, drift unceasingly towards the efficient and the good, the harmonious, the beautiful and the true.

What else do we gain from recognizing that we can neither ensoul Nature after the manner of primitive man, nor personalize it in the larger fashions of anthropomorphic thought? Let us rather ask what we can lose of all that is of deepest import for us as living and as human. Already the answer has been suggested. Such personality as we know rests on a foundation of impersonal characters neither consciously originated nor consciously directed. Will, instead of having power over the nature of things, is rigidly confined to the arrangement and rearrangement of things already possessing a nature of their own. The voluntary activities of the organism, instead of dictating a law to the properties of matter, are themselves determined by those properties. That the internal organs of our own bodies function without let or hindrance on our part, that even the nexus between conscious effort and voluntary action invariably evades our scrutiny, suffice to remind us that the profoundest things in our lives are not personally, but impersonally regulated — that personality, instead of supporting, is itself supported; that instead of originating power it is the outcome of preëxisting power. To found cosmic processes upon personality is to undermine our trust in their integrity and bring the thought of our relation to the universe into inextricable confusion. By no manipulation of metaphysics can we trace the so-called origin of things to the putting forth of will; by no utilization of physics can we trace their changes to the incidence of conscious effort. To believe that electrons, atoms, molecules can be whirled about or thrust together, that suns and planets can be thus impelled, to the culmination of the cosmic process in life, is to surrender all the experiences of change which we have gained from our study of Nature. The larger the intelligence the more impersonal does it become. A personal attitude, with purpose and plan for its method, may contrive out of preëxisting material the match and the locomotive, may devise the chronometer and the dynamo, may turn man's magnified eye upon the celestial wonders. But we cannot, even by multiplication to infinity, expand it into a power to paint the simplest pattern on the wing of a butterfly, to dot the sea-worn rock with the tiniest shell, or coöperate with the wind in producing a single dandelion seed. For the development of these we must turn, not to "omniscience" working like a human craftsman with plan aforethought, but to the Omnipotence that without will maintains the properties of things unchanged, without knowledge determines how the light shall fare, and without consciousness returns sun, moon and planet to their places in the heavens.

But Nature is rich in bounty, and we may surely entertain the thought of a definitely directed endowment which, bestowed upon personality, must emerge from personality. To what extent are personal benefits inextricably linked with the personal attitude? The suggestion finds little comfort in the deeper aspects of human beneficence. It is emphatically negatived by the coöperative solidarity of the race. Millions of our fellow beings in every part of the world contribute daily and hourly of their thought and toil for our welfare without one of them standing in any sort of personal relation to us. Would it help, would it not fatally embarrass, the process by which they serve were we to insist on each worker having in mind some particular individual as the goal of his effort? The provisioning of cities and communities now gets itself accomplished impersonally: with what chance of improving the work could we propose the concentration upon each person to be benefited of a definitely directed will? Nor is there any element of individual direction in the institutions, conveniences, regulations, which make up so much of the good of our lives; benefit from even private enterprises comes to us impersonally, not through any philanthropic attention to purely individual interests. Does the beneficence of one community to another in time of calamity depend on any personal attitude towards each of the sufferers relieved? Is it not rather given with the same broadcast impersonality as that which is showered on us by Nature herself — with the impartiality towards "good" and "bad" alike which is the attitude of the rippling water, the flowing air and the abounding sunshine?

The vast yield of the human past to the human present is an overwhelmingly impersonal contribution. If living men whom we know are occasionally and spasmodically kind to us, dead men who never knew us are kinder still, and are unceasingly kind. Most of them — untold millions of them, have blessed and continue to bless us from the cross of their vicarious sufferings as unconscious benefactors who never saw us and never even dreamed that we would exist. And that which is true of the collective bequest is true also of the individual gift: through ages of invention and discovery — slow acquirement of nature knowledge, slow mastery of material and development of form — the impersonal attitude has never varied. For a few short hours, for a few brief moments of each day, every great benefactor was indeed personal to his contemporaries. A few glimpses of him as he passed along; a few meetings with friends; a few conversations or discourses forgotten and recorded; a few benefits conferred on a small number of persons within an extremely limited period — this was the sum of the personal attitude of the mightiest. Contrast with such meager product the results of individual achievement as it came to be multiplied into terms of impersonal service to the race. Would any of us, for the scant privileges of the personal attitude, barter away or even imperil the yield of human effort in the past, the promise of yet grander contributions in the future, those conquests in every realm of thought and action which, lifting life to higher levels, widening the sympathies of men, and glorifying Nature, have given us not only new heavens and a new earth, but also a new universe?

The men who ensouled Nature in advance of the power to comprehend it resemble the men who looked out upon the sea and stars before the days of navigation. Ashore, in the sheltered alleyways and safe retreats, the most inexperienced could orient themselves: the rocks and hills interposed no insuperable barrier to intimate acquaintance; the lore of the streams could be easily acquired. But when early man left these familiar abiding places for the gray old ocean, his march was stayed by its vastness and incomprehensibility. Here simplicity, ignorance, confidence could no longer avail. Exact knowledge was needed — knowledge of the tides and winds, and of their depth and strength; knowledge of buoyant materials and of the shapes best adapted for their use; knowledge of direction and how to find it beyond sight of land; then knowledge of the shape of the earth, of the positions and movements of the heavenly bodies; last of all, an instrument to tell direction in weather cloudy as well as clear, and an instrument to tell the time. No wonder that through ages of human development man never ventured away from his confining shores, and that only by degrees, putting aside his fables about the ocean, learning all that was needed for successful navigation, he was at last able to orient himself amid the trackless waters as well as on the firm earth.

We, too, of later date, were slow to leave the palms and fruit trees of our tropical island, content by day with the dazzling landscape, by night satisfied with the tales the landsmen told us about the sea, whose heaving boss they had never crested, about the stars overhead, with whose names they were not even familiar. It was the old story of men who, knowing nothing more of the sea or stars than we did ourselves, had received their legend from ancient time and cared only that it should be handed down unmodified. But other voices have reached us in these modern days — from the sounding ocean, which has been circumnavigated, and from orbs overhead which have been analyzed and weighed. With the earth transformed for our vision and the sky brought closer to our understanding, we have begun to look out upon Nature with a reverent desire to know more of it than even science has yet been able to reveal. Fain would we plummet the ocean of power whose surface waves, now peaceful, now turbulent, hide the secret of their being and of ours in depths profounder than pantheist ever dreamed of, than it ever entered into the heart of deist or theist to conceive! Yet the yield of man's age-long questioning is already ample for our needs. Henceforth, as citizens of Nature, members of the great tribe of life, our dealings are with modes of government which we have rationalized and can comprehend. And our allegiance is yielded to no *roi fainéant,* idle by choice or inactive because unnecessary — bodily separated from the world and supplementing it at will, or universally diffused as a ghostly psychic vapor which has to reckon with that which it pervades — but to an Almighty at once regnant in things and transcendent over them, the ultimate source and fashioner of all they are and do, freeing each into its own nature and ruling each with the assembled potencies of all.

The world fashions itself anew for us, and all the more grandly, as we realize that the objects we have so long intellectually separated form a together, an interdependent, interdetermining totality, every unit and area of it system-sourced — that as human intelligence derived from cosmic intelligence we are really one with the universe we contemplate, strong with its power and sharing in its work, however subject to its process. As our midnight constellations grew not less but more beautiful to the race because it ceased to think of them as deified animals and men, so our woods take on a new glory when, instead of viewing plant, insect and bird as products of consciously imposed plan, we recognize in them the intelligence, the freedom and the wonder of delegated universe power. To be convinced that the process which reveals itself within us as purpose is the same process that spreads the spider's web, builds up the flower, shapes the crystal, presides over the gathering of the planets and guides the marshaling of suns, is to make Nature dear to us beyond the lure of myth or the persuading of poetry. And with Nature thus refashioned, man undergoes a like transfiguration. Behind each act of helpfulness to one's fellows, to one's group, to one's kind stretch the countless acts which make up the sum of human experience. Related to all doings in the past, to all doings in the present, to all doings in the future, conduct comes up and in to us charged with deep and solemn meanings. The soul of things unseen enters into the simplest service we give or receive; the labor for which we pay or are paid grows rich beyond all thought of its money value; for the broader vision, all days seem sacred which the sun bestows on its planetary family, and each hour given to worthy effort is consecrated.

Only as we persist in reading human motives and meanings into the cosmos will Nature, life and man continue to demand justifications which they do not need, and to arouse expectations which they cannot satisfy. Pessimism, like the "problem of evil," is for the subjective view alone. If differences are required for knowledge, action must also have its contrasts if we are to have any sense of values. If there is to be advance from bad to good, and from good to better, the world must be a process, as well as an extension, and there must be struggle as well as change: better the busy strife of an ant-hill, with life growing from more to more, than a whole universe made perfect at the cost of stagnation. Errors to be dispelled, wrongs to be overcome, faulty individual adjustments to be set right, social and political adjustments to be improved — these are our opportunities in a régime where the what is, however determined by past and present, is being continually transformed by the what ought to be. In epochs far distant the "sound of the grinding" will be high or low within us; in many a weary land yet to be trodden we shall need the shadow of a great rock. But a stern joy should be ours as we face the new Nature and realize that, in sunshine and in storm, it has neither favors to dispense nor gratitude to earn, that it chastens without dislike as it blesses without partiality, and that its remoteness from complaint and supplication is our felicity, not our misfortune. Only under such a government can we fully surrender our hope of an individually directed good to the demands of an all-inclusive justice; only in such a dispensation may we safely commit our fears to the power which has kept the earth immune during the aeons that have gone to the making of the higher life, which still decrees that the seasons shall be processional from year to year, and gives us the assurance that the darkest hour shall continue to be followed by the dawn.

CHAPTER L

PARALLELS BETWEEN RELIGION AND SCIENCE

Religious views and scientific views of the world are usually held to need harmonizing by a more or less forced process, as if they were separated from each other by an almost total difference of kind. The two really spring from a single root in knowledge, the one representing an earlier, the other a later stage in the evolution of the knowing faculty: the reconciliation between them most needed is that which reveals the origin they have in common and the ways in which they have been differentiated. Men first trust to their senses and employ what may be roughly called the subjective method; later, as the intellect asserts itself, they use appearances as so much raw material for the deeper knowledge which is reached beyond sensation by the discovery, so far as may be, of what Nature is for herself. Here is suggested the difference between that naïve view of color which treats it as inhering in the object and the scientific view which locates color in the organism and its cause in vibrations of the ether. The subjective method taught the ancients that the sun and moon were round, flat disks, that the earth stood still, and that the heavily bodies moved around it; only by resort to the objective method did they learn the facts which are to-day the commonplaces of our modern astronomy. It was the same subjective attitude towards nature phenomena which made it impossible for our ancestors to understand the cosmos save by attributing its changes to will and personality; only when Nature came to be studied objectively, with the deliverances of the senses subordinated to the deliverances of the intellect, were its actualities revealed. Progress in our knowledge of the universe has been achieved by the gradual substitution of the objective for the subjective method of interpretation, and the change has taken place not for the gratification of any abstract preference for one, as contrasted with the other, but because the interests of the race demanded, not only knowledge of how things were related to us, but also knowledge of how they were related among themselves. We are therefore entitled to look for a sustained parallel, correspondence or congruity between the two attitudes towards phenomena; and as all early explanations are the subjective forms of the later objective explanations, we shall find that while the truer view displaces the more imperfect view, it is always symbolically prefigured in the latter.

As the early scientific hypotheses thus anticipate the later theories which supersede them, so generally do religious views adumbrate, resemble and symbolize scientific views. In their advanced stages, the ideas of science and religion are everywhere fundamentally alike, and point to a single origin as their common source. The unity which the scientist sees in nature was sung more than five thousand years ago in the Valley of the Nile as the unity of God. The ordinary view of the universe as infinite has had its parallel in every theistic system, and the modern doctrine of the unknowable was already announced in the inscription on the fane of the temple of Athene-Isis at Sais, "I am all that was, and is, and shall be; nor my veil, has it been withdrawn by mortal." For the Almighty and Omnipotent of scriptural phraseology we have modern equivalents like that of Herbert Spencer ("First Principles," p. 112), "The Power manifested through all existence," and that of Matthew Arnold, "The Eternal Power, not ourselves, which makes for righteousness." Many definitions of religion, moreover, are little more than scientific truths expressed in theological terms. Thus Schleiermacher declares that "religion consists in our consciousness of absolute dependence on something which, though it determines us, we cannot determine in turn." Pfleiderer describes the kern of religion as "the relation of our life to the world-ruling power which is to share life with it" (*jene Lebensbeziehung auf die weltbeherrschende Macht, welche zur Lebensgemeinschaft mit ihr werden will*). To Max Müller religion is "the perception of the infinite under such manifestations as are able to influence the moral character of men." Herder traces the origin of religion to "a feeling of the invisible in the visible, of the one in the many, of power in its effects, as the root of all ideas of the reason." For Schleiermacher the "contemplation of the universe," and "the feeling of the infinite in the finite" was the pivot of all religion. Strauss boldly defined religion as feeling for the universe (*Gefühl für das Universum*).

How inevitably, in their expression of religious emotion, men turned for the object of their worship to conspicuous characters of the external system is shown by such deistic epithets as Shangti (Supreme Heaven), Dyaus-Piter, Zeus, Jupiter (Sub Jove); by the widespread belief in gods sprung from the union of heaven and earth — the regnant feature of hundreds of primitive religions — and by the multifarious forms of sky, sun, and star worship. In some mythologies the external system is declared to be identical with the Deity himself. "God," runs an Orphic saying, "is the head and middle of all things. God is the abyss of heaven, the depth of the sea, and the life of all breathing creatures. All these three, abyss, depth, and life are parts of His vast body." In the sacred song of the Hindu we read of Purusha, and that from the sacrifice of him sprang horses and all animals — the moon from his soul, the sun from his eye; from his navel arose the air, from his head the sky, and from his feet the earth. The Scandinavians also pictured the universe as one, for the sons of Borr took the universe giant Ymir, and of his flesh they formed the earth, of his blood the seas and waters, of his bones the mountains, of his teeth the rocks and stones, of his hair all manner of plants, of his skull the firmament, and of his brains the clouds. In Chaldean story, Bel, having cut the world woman Omorca in twain, converts the two halves of her body into heaven and earth. For Egyptian, as for Greek, plants, stones, metals, and other natural objects arose by like metamorphosis from the bodies of once-worshiped gods. Among the Iroquois Indians Chokanipok was a universe giant whose limbs, bones, and blood had been utilized to the making of the world. To this day the South Australian regards the universe as the great tribe, to one of whose divisions he himself belongs, and all things animate or inanimate which belong to his class as portions of the body corporate of which he himself is part.

The immanence of God in things — the omnipresence of that Power which science sees everywhere in the universe — finds the most constant and withal multifarious expression in theological and quasi-theological writings. "Fool!" exclaims Carlyle ("Miscellanies," Vol. 5, p. 49), "God is not only *there,* but *here,* in that life breath of thine, in that act and thought of thine — and thou wert wise to look to it." Jelaled-deddin, a saint of the Persian sect of Sufis in the twelfth century, was the author of the saying: "When we cry in our prayer, 'O my Father,' the answer is in the prayer itself; in the 'My Father,' lies hidden 'Here, my child.'" The Platonic Bishop Synesius sang:

Thou art the begetting,
And the begotten:
Thou art the illumining,
And the illumined:

Thou art the manifest,
And the hidden — hidden by thy glories:
One and yet all things Thou,
One in Thyself alone,
And throughout all things One.

The like idea, in its Eastern form, is also reached in the "Brahma" of Emerson:

If the red slayer thinks he slays,
  Or if the slain think he is slain,
They know not well the subtle ways,
  I keep, and pass, and turn again:

Far or forgot to me is near;
  Shadow and sunlight are the same;
The vanished gods to me appear;
  And one to me are shame and fame;

They reckon ill who leave me out;
  When me they fly, I am the wings;
I am the doubter and the doubt,
  And I the hymn the Brahmin sings.

Paul declares that God is "the fulness that filleth all things," that the Deity is "above all, and through all, and in us all," that "in God we live and move and have our being," and that "from Him, through Him, and to Him are all things." Spinoza held God to be "the underived, original, and universal force underlying and including all forces." For Vico "God knows all things, because He contains in Himself the elements of which He composes all things." "There is," says Descartes, "but one infinite substance, and that is God. Whatever is, is in God, and without Him nothing can be conceived. He is the Universal Being of which all things are the manifestations." Malebranche also described God as "the absolute substance" who "contains all things in Himself." "When we assert that God is infinite," writes Conder ("Basis of Faith," p. 65), "we mean . . . that God is present where-ever space extends." Sir Isaac Newton maintained that God, by existing, constitutes time and space, and Dr. Clarke urged that space is an attribute or property of the infinite Deity. Pope wrote of a God who

> Lives through all life, extends through all extent;
> Spreads undivided, operates unspent:
> To Him no high, no low, no great, nor small —
> He fills, he bounds, connects and equals all.

The essential identity of God with nature, now described as the world and now as natural laws, has been constantly asserted in one form or other since the beginning of clear thought. This conception is expressed in the Rig Veda, where, as rendered by Sir Monier-Williams ("Mandala," x. 90) the "embodied spirit" is "himself this very universe — whatever is, has been, shall be." "In point of Being," according to Zeller, the Stoics regarded "God and the world" as "the same; the two conceptions are identical." For Schleiermacher "God and the world are two values for the same thing" (*zwei Werthe für die gleiche Sache*). Herder said that no God was possible without a world, just as no world was possible without a God (*Es ist also kein Gott ohne Welt möglich, sowie keine Welt ohne Gott*). Pope's lines,

> All are but parts of one stupendous whole
> Whose body nature is and God the soul,

contain the same idea as that which Goethe puts into the mouth of the earth-spirit in Faust:

> *So schaff' ich am sausenden Webstuhl der Zeit,*
> *Und wirke der Gottheit lebendiges Kleid:*

"From this point of view," wrote W. B. Carpenter ("Nature and Man," p. 53), "I should look upon the whole Kosmos as the corporeity of the Deity, a doctrine which some may think pantheistic, but which seems to me necessarily to follow from that of His universal and immediate agency, which I cannot but regard as the highest method of viewing his *modus operandi.*" Strauss has urged that there are no attributes of God which are other than the laws of Nature, and Herder (" On Man," Preface, xiv.) writes:

> Nature is no real entity; but *God is in all His works. . . .* Let him to whose mind the term nature has been degraded and rendered unmeaning by many writers of the present day, conceive instead of it that *almighty power, goodness and wisdom,* and mentally name that invisible being, for whom no language upon earth can find an expression.

For Hume the proofs of the existence of God depend on the conception of cause; St. Augustine ("Confessions") declared that " whatever leads to the knowledge of God has value, and therefore physics is justifiable, which, if it did not lead to this result, would be quite useless"; and Francis Ellingwood Abbot ("Scientific Theism") asserts that "in the final upshot, what men think of God must depend on what they know of nature, and that knowledge is science." On Theism and Atheism J. R. Seeley ("Natural Religion") writes:

> I say that man believes in a God who feels himself in the presence of a Power which is not himself, and which is immeasurably above himself, a Power in the contemplation of which he is absorbed, in the knowledge of which he finds safety and happiness. . . . The average scientific man worships just at present a more awful, and, as it were, a greater Deity than the average Christian (p. 18). . . . Whether they say God, or prefer to say Nature, the important thing is that their minds are filled with the sense of a Power to which their own being is inseparably connected, in the knowledge of whose ways alone is safety and well-being, in the contemplation of which they find a beautiful vision (p. 22): . . . Since every sort of theology agrees that the laws of Nature are the laws of God, it is evident that in knowing Nature we do precisely to the same extent know God. Regarded in this way, we may say of God that so far from being beyond knowledge, He is the one object

> of knowledge, and that everything we can know, every proposition we can frame, relates to Him. . . . Scientific men do now tell us in the very language of theology that all hope, that all happiness lies in the knowledge of Nature and by Nature they mean the Universe. (P. 51.)

The view implicit in science that the universe as a whole is the cause of all the movements, changes, and modifications that take place within it finds its natural parallel in the theological view that God is the source, author, and maker of things. The Stoics taught that "God is at once universal matter and the creative force which fashions matter into the particular materials of which things are made." Leibnitz declared God to be "the primitive unity, the simple, original substance, of which all created or derived monads are the products." Herbert Spencer ("Religion: A Retrospect and Prospect") took account of "an infinite and Eternal Energy, from which all things proceed," or, as originally written, "an Infinite and Eternal Energy by which all things are created and sustained." To John Fiske the "infinite Power that makes for righteousness" is also "the everlasting source of phenomena." The Rig Veda ("Müller's Ancient Sanscrit Literature," p. 569) adores God as the giver of light, the creator of earth and heaven; "I have made the earth," sings the prophet Isaiah, "and created man upon it; I have stretched out the heavens. . . . I am the Lord that maketh all things." "That everything is from God," says Schelling ("Werke," Abth. 2, Vol. 2, p. 280), "has been at all times felt, as it were — nay, one may say that just this is the true primitive feeling of humanity." Martineau declares that "God is no longer conceived as the First Cause prefixed to the scheme of things, but as the Indwelling Cause pervading it — as the One everlasting Objective Agency, the modes of which must be classified and interpreted by science in the outer field, by conscience in the inner." The hymn of Proclus expresses the Orphic idea of the Deity:

Zeus is first, last, the head and middle of all things:
From him all things come: He is man and woman;
The depth of the earth, the height of heaven,
Sun, moon, stars, fire — origin of all, king of all,
One Power, God, Ruler.

"All that lives," wrote Cleanthes, the Stoic, "all that moves, all that exists as mortal upon the earth, we are all born of thee. . . . This universe suspended over our heads, and which seems to roll around the earth, obeys Thee alone; it moves and is governed in silence by thy command." To Aristotle God is "the first mover, imparts motion, and pursues the work of creation as something to be loved." Dante ("Paradiso," Canto Primo) writes of

La gloria di Colui che tutto muove,

and Bruno ("Opere," Vol. 1, p. 209) addresses the Deity as

Causa, principio, et uno sempiterno,
Onde l'esser, la uita, il moto pende.

Wordsworth, in one of his poems, acknowledges a Power

Whose dwelling is the light of setting suns,
And the round ocean, and the living air,
And the blue sky, and in the mind of man;
A motion and a spirit that impels
All thinking objects, all objects of all thought,
And rolls through all things.

Adi-Buddha is described in Sanscrit literature as one who, "himself not made, has made all things." At Thebes, Amun-Ra was worshiped as "Maker of all things, above and below"; so Osiris "made the world and all things, and maintains law in the universe." The Vedic God, Varuna, is credited with the saying, "Like a clever carpenter, I have fashioned all things and supported heaven and earth." Finally, scientific and theological truths meet for the modern mind in the child's hymn:

Each little flower that opens,
  Each little bird that sings —
He made their glowing colors,
  He made their tiny wings.

A similar parallel is to be noted in the realm of causality. Thus Pfleiderer (" Development of Theology in Germany Since Kant ") summarizes Schleiermacher's position regarding causality in the following language:

> God is the correlative unity to the multiplicity presented as the world. Creation and preservation are forms of expression for the eternal causality or omnipotence of God, which is so completely represented in the totality of being that in the divine omnipotence there is no excess of potentiality beyond the totality of the actual nor in the latter anything in excess of the former. Omnipotence and the totality of natural causes are commensurate, the former never coming in the place of the latter to meet a defect, but everything exists and arises solely and wholly by means of the natural system of things; so that, each thing existing by virtue of all, and all things entirely by the divine omnipotence, all things undivided subsist through one (p. 111).

Note also the frequent reference of forces and their effects to the operation of a divine will. Sir William Grove, for example, maintained that " causation is the will, creation the act of God." In Sir John Herschel's view, " it is but reasonable to regard the force of gravitation as a direct or indirect result of a will or consciousness existing somewhere." " There is no such thing," asserted Clarke (" Evidences of Natural and Revealed Religion," p. 300), " as what men commonly call the course of nature. The course of nature, truly and properly speaking, is nothing else but the will of God producing certain effects in a continued, regular, constant, and uniform manner." The Duke of Argyll (" The Reign of Law," p. 127) urged that " it may be that all natural forces are resolvable into some one force," adding: " It may also be that this one force, into which all others return again, is itself but a mode of action of the Divine Will." Martineau has held that "Theism is at liberty to regard all the cosmical forces as varieties of method assumed by God's conscious causality, and the whole of nature as the evolution of his thought."

CHAPTER LI

PARALLELS BETWEEN RELIGION AND SCIENCE
(*Continued*)

All mysteries in religion are ascribed to some divine power, attribute, or way of acting not yet understood, just as all mysteries in science are attributed to unexplained powers and modes of movement in the universe. It thus constantly happens that the difficulties of the theologian are at bottom the difficulties of the scientist, and that the clearing up of the mystery of the one is the solution of the problem of the other. "By conceiving of life," says George Henry Lewes (Aristotle, p. 231), "simply as the function of the organism, we do not rob it of its solemn mystery. It is still the dark Dynamis which must ever remain impenetrable; but a similar mystery hangs over the course of the planets, the ebb and flow of the tides, the vehement impulses and repulsions of the chemical elements." Here we see characterized by a common term — as if the very nature of thought connected them, demanding a single solution for all — those phenomena which in the scientific view need the universe to explain them, namely, life, gravitation, and chemical action. From a totally different point of view, yet with a suggestiveness not less profound, Tennyson sings:

> Flower in the crannied wall,
> I pluck you out of the crannies;
> I hold you here, root and all, in my hand,
> Little flower — but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is.

The poet perceives the divine in the humblest type of animate existence, and in doing so expresses the objective truth that knowledge of the meaning of the life of the simplest flower would involve knowledge of the relation in which man and all other organisms stand to the universe, and therefore knowledge of the universe as the ultimate *raison d'être* of life in all its manifestations. One other example of the same kind of parallel may be cited from "The Prayer of Agassiz":

> Said the master to the youth,
> "We have come in search of truth,
> Trying with uncertain key
> Door by door of mystery;
> We are reaching through His laws
> To the garment-hem of Cause —
> Him the endless, unbegun,
> The Unnameable, the One,
> Light of all our light the Source,
> Life of Life, and Force of force;
> As with fingers of the blind,
> We are groping here to find
> What the hieroglyphics mean
> Of the Unseen in the seen;
> What the thought which underlies
> Nature's making and disguise;
> What it is that hides beneath
> Blight and bloom, and birth and death."

Whittier here refers the mystery of life, with its characters of "blight and bloom, and birth and death," to the unseen source of things, while in describing that source he uses epithets which few scientific thinkers would hesitate to apply to the universe.

The theologian's submission to the will of God reappears for the objective method in the calm content with which the student of nature accepts the ceaseless working and interworking of the forces around him. Even the so-called pagan addresses the universe in this modern spirit.

"Dare," says Epictetus, "to lift thine eyes to God and to say, 'Use me for what thou wilt. I agree, and am of the same mind with thee. I refuse nothing that seems good to thee. Lead me where thou wilt, and I will go.'" The same writer expands his idea in this language:

> All things obey and serve the world (universe) — earth and sea and sun, and the rest of the stars, and the planets of the earth and animals. And our body obeys it also, both in disease and in health, when it (the universe) chooses, both in youth and in age, when it is passing through the other changes. What is reasonable, then, and in our power, is this, for our judgment not to be the only thing which resists it (the universe); for it is strong and superior, and it has determined better about us by administering (governing) us also together with the whole. . . . Wherefore we also ought to be of one mind with God, and making this division of things, to look after those which are in our power; and, of the things not in our power, to intrust them to the Universe.

Pope's view that "partial evil" is but "universal good" found early expression in the writings of Antoninus:

> Everything harmonises with me which is harmonious to thee, O Universe! Nothing for me is too early nor too late which is in due time for thee. Everything is fruit to me which thy seasons bring, O Nature! From thee are all things, in thee are all things, to thee all things return. The poet says "Dear city of Cecrops," and wilt not thou say "Dear city of Zeus"? . . . Let the perfecting and accomplishment of things which the common nature judges to be good be judged by thee to be of the same kind as thy health. And so accept everything which happens, even if it seem disagreeable, because it leads to this, to the health of the universe, and to the prosperity and felicity of Zeus (the Universe). For he would not have brought on any man what he has brought if it were not useful for the whole.

The idea also occurs in Goethe:

> Well may each separate self its life forego,
> In the infinite to find itself, and so
> Be freed from disappointment evermore;

Where fevered wishes, wild desires, once reigned,
Where hard laws ordered, strict commands constrained,
"To give up self is bliss," is now my lore.

To the same class belongs Cardinal Newman's hymn:

Lead, kindly Light, amid the encircling gloom,
Lead Thou me on;
The night is dark, and I am far from home,
Lead Thou me on;
Keep Thou my feet: I do not ask to see
The distant scene; one step enough for me.

I was not ever thus, nor prayed that Thou
Shouldst lead me on;
I loved to choose and see my path, but now
Lead Thou me on;
I loved the garish day, and, spite of fears,
Pride ruled my will; remember not past years.

So long Thy power hath blessed me, sure it still
Will lead me on
O'er moor and fen, o'er crag and torrent, till
The night is gone;
And with the morn those angel faces smile,
Which I have loved long since, and lost awhile.

And if it be asked why the scientist's attitude towards the universe process should partake of the spirit of the child's supplication, "Thy will be done on earth, as it is in heaven," the reply may be given in the words of Carlyle: "All that is right includes itself in this, of co-operating with the real tendency of the world." This has been expanded by John Beattie Crozier ("The Religion of the Future") into the passages:

> A few simple principles, endlessly varied and combined, make up this magnificent panorama of life. . . . On an attentive consideration, then, we shall find that they all work for the good of the whole, that is to say, for justice, and that the result is a gradual progress and amelioration (p. 21). . . . The great laws — physical, organic, and spiritual — work impar-

> tially for the benefit of all; and he who best obeys them is the most in harmony with the decrees of his Maker, and, in the great sense, alone succeeds (p. 25). . . . As the central Law of the world is Justice and Goodness, of which the thousandfold complexities of physical and organic law are instruments, so the central Law of man is dependence on that just and good will; all the superficial laws of his nature, physical and organic, being merely instruments of this central Law — subsidiary and subordinate to it. Hence the first duty of man is self-renunciation. This is a total change of heart and will, or, in other words, a conversion. It is what is known in Scripture as a being "born again." (Pp. 29, 30.)

That yielding oneself "to the perfect whole" comes really from a belief that "All things work together for good to those who love God," has often found scientific expression in a variety of forms. Thus Vico, as summarized by Robert Flint, believed "all that happened was for the best, and that the severest sufferings of humanity were of a remedial and educative character. Even the punishments which destroyed nations he held to be needed; the most savage passions could be shown to have been made instruments of good; and the darkest superstitions he regarded as approximations to truth and as instructive even in so far as false: *'Nelle stesse tenebre degli errori splende Iddio.*" Kant ("Ideen zu einer allgemeinen Geschichte") applies this view to the antagonism between the egoistic and the social impulses in man; and Maudsley ("Body and Will," p. 168) sees the like truth in all human actions:

> In the social state the egoistic passions of men — their antagonistic rivalries, jealousies, emulations, ambitions, avarices, and the like, being constrained and utilised in spite of themselves to serve the common good — are really the conditions of social progress.

It may be said generally that all fundamental deliverances in theology and religion are but so many subjective aspects of fundamental truths in science. Thus the subjective truth that God is an intelligent being, partially reiterated in quasi-scientific descriptions of the universe as consisting of "mind-stuff" (Clifford) or as containing "the indwelling mind of all" (Martineau), in the frequent ascription of mental characters to the divine mind, declared to be the prototype of the human mind, and in the view that organic forms are concrete thoughts of the Creator (Agassiz), reappears for the objective method in the form of the truth that all activities of the universe take place in definite, unvarying ways, which may be called universal laws, and that the intelligent adaptations observed in organic life are ultimately due to the universe. The saying, common to most systems of religious belief, that everything happens by the will of God, is a subjective expression of the scientific verity that no change of any kind or amplitude can occur save as determined by universe power. The belief that every birth and death is alike an act of God — long rejected as superstition — is here seen to be but an aspect of the truth that the universe is instrumental in giving existence to organic forms, and in removing them when their cycle is run: the universe being, in the scientific, as in the Hindu conception, not merely the creator and maintainer of the organism, but also its destroyer. The statement, again, that all knowledge is from God must be regarded for the purposes of the present comparison as equivalent to the assertion that the material of knowledge comes to us from the external system, and is, like life itself, a product of that system. The belief that men may be inspired by God, as well in its primitive form that particular men may be so inspired, as in the modern form according to which the highest thoughts of all men are regarded as due to divine inspiration, has its objective parallel in the scientific view that all thought, and all ideas, are ultimately communicated to human beings by the universe, and that the higher thoughts, like the higher aims of men, are results of the universe process. Thus the view that God has revealed Himself to man is the subjective aspect of the truth that the universe, as a whole, has impressed a knowledge of itself upon its highly complex, its highly unified part, the human organism. For that early form of the subjective view which divided processes into "natural" and "supernatural" means objectively no more than that processes understood excite no wonder, while those not yet explained are marveled at and regarded as mysterious: every step taken by science into the unknown being so much territory won from the supernatural and annexed to the natural — so much conversion of the magic and sorcery of the savage, the miracle of the theologian, into the phenomenal commonplace of the scientist.

In morals the same parallels are to be noted between the subjective and the objective view, all facts of duty, conscience, right and wrong being as clearly expressible in objective terms as are any of the fundamental doctrines of theology. Righteousness in the widest meaning of the term is that complete adaptation to the human and the natural environment which results to the organism in the highest possible well-being or blessing; so the sin which, in the subjective view of the theologian, offends God, is in the objective view of the scientist conduct which is injurious, or is believed to be detrimental, to the welfare of the human group or kind, and therefore opposed to that general process of things of which the universe is the ultimate determiner; while the testimony of conscience proclaiming an action to be right or wrong is from the objective point of view the testimony of organized racial experiences prescribing conduct which is socially and individually beneficial, deterring from conduct which is socially and individually injurious. Finally, the warning of the theologian that compliance with the divine commands yields happiness, and that the disobeying of them brings punishment, has its not less impressive parallel in the creed of the scientist which declares (Herbert Spencer, "Controversy with Frederick Harrison") that "there is an Order of Nature pervading alike the actions going on within us and without us, to which from moment to moment our lives must conform under penalty of one or other evil; and . . . therefore our first business must be to study this Order of Nature."

Nor is the belief in immortality altogether without its objective analogue. We may connect it scientifically with many theories that merely imply as well as explicitly assert the certainty of the future life — theories like those, for example, which proclaim the transmigration of the soul, hold that men inherit good or evil from a previous state of existence, or provide for them in coming states a series of rewards and punishments. These without exception have their objective side in the general fact of the potential immortality of the organic type — in the inevitable inheritance from previous generations, the inevitable descent to succeeding generations, of all improved characters and all maladaptations that succeed in establishing themselves in the structure of the organism. For if the scientific view of the meaning of heredity be true, it must be clear that, in all its fundamental characters — in all, that is to say, save conscious individual experiences — the organism really lives again in its offspring. Thus the intensity of one's faith in a future life, whatever other justification it may have, is confirmed from the objective point of view by the tremendous importance of a process which, while it makes man but one link in the chain of human existence, yields him glimpses of that before and after with which he is indissolubly bound — glimpses of the past from which he has come, which has made him what he is, glimpses of the future which he also assists to mould, and in which his present actions must find themselves again for good or ill in the stream of human events:

Our birth is but a sleep and a forgetting;
  The soul that rises within us, our life's star,
Has had elsewhere its setting,
  And cometh from afar.

These examples of the correspondence between religious and scientific ideas are brought forward to suggest, not that religion and science are the same, not that the God of the theologian and the universe of the scientist are the same, but that the ultimate object of worship and the ultimate object of knowledge are for the objective method identical, and differ only for the subjective mode of envisaging them. This is true, moreover, even in cases where the divergence seems wide: thus the so-called worship of the infinite is really worship of the Power which is believed to be infinite, and not of any quality of infiniteness abstracted from existence — of the power, that is to say, to which no limits can be assigned; so men worship the Power they believe to be a Unity, to be Eternal, or Unknowable, and not any of the qualities which they ascribe to that Power. It is also to be noted that the supposed creation of the universe as the totality of things constitutes no negation of the meaning of causality as here set forth, since such totality signifies in every case no more than the visible universe of earth, sun, planets, and stars — not the ether system, which has only recently come into the realm of knowledge, but simply the whole of material things in the narrower and older sense of the term "matter." The truth that matter thus conceived could not move itself, could not rearrange or "create" itself, seems to have been perceived from the earliest times, and so the theologian, far in advance of the formal processes of the scientist, reached the idea of some invisible power to which all things were due. "The invisible things of Him from the creation of the world," says Paul, "are clearly seen, being understood by the things that are made, even His eternal power and Godhead." Calvin declared that God "by creating the world (*mundum*), being Himself invisible, has presented Himself to our eyes conspicuously in a certain physical form."

The search of the theologian for a cause behind the visible world of matter is fundamentally of the same kind as the quest of the scientist for an ultimate system of things regarded as source and cause. Worship is always directed to the external system — to that which has power over the worshiper and over the conditions which limit and determine his existence; it finds its goal, that is to say, in the universe, or in parts thereof representing the universe; it is directed to representative external objects, to representative essences believed to reside in those objects or to that which, while formally conceived of as outside of and distinct from the universe, is yet logically conceived (by assumptions made as to its connection with and power of giving rise to and of acting on the system) as forming part of, and being to a greater or less extent identical with, the universe. The idea of God and of the universe, meeting so manifestly in the causal relation, come together again in the conception of personal welfare, since the theologian is as strenuous in claiming that it is to the interest of the human being to know God and His laws, as is the scientist in holding that it is to the interest of the organism to know the universe and its processes: if the object of worship were not also the ultimate object of knowledge, this aiming at personal welfare in both worship and knowledge would be unintelligible.

CHAPTER LII

WORLDLINESS AND OTHER-WORLDLINESS

HERE, at the close of our survey, the two views again present themselves — the attitude of science, bent on conquering nature that it may enlarge the bounds of knowledge in the interests of man; the attitude of art, esthetics, poetry and religion, each eager to serve human life, yet all swayed by emotion and fond of reading subjective values into the world at large. Let us contrast the yield of the one with the demands of the other as a preliminary to such estimate of both as the evidence seems to warrant. We have already seen that loyalty to knowledge requires us to part company with anthropomorphism in all its guises. Since intelligence, in the ordinary use of that term, cannot arise save in organisms, as ancillary to self-maintenance, we are warned off from attributing consciousness to the inorganic, either as one or as many, either as transcendent over things or as immanent within them. The intellect rebels alike against the effort to compress the *psyche* into ultimates, and the attempt to expand it into a universal. What we find in the inorganic is a power-system going its own way, under its own control, not needing to be supplemented; what we see in the organic is living bodies freed from all guidance save that of their own natures and the natures of their environments; what we must admit for man as individual and as society, in his aberration and in his wisdom, is a superior organism equipped for life only as he may carry it on for himself.

But account must also be taken of another view of things. The personality which science ignores in nature, or excludes from it, threatens to return by another route. Respect them as we may, utilize them as we must, the bare facts of knowledge do not suffice for humanity in the mass. Cognition, simple or complex, with percepts and concepts for its yield — here marshaled in trains of reasoning, there expanded into principles and laws — is not the only activity of the mind. The creative imagination, with its fondness for analogies, its love of rhythm, its delight in harmonies, whether of sight or sound, is also potently at work. Our reverence is willingly accorded to "the majesty of fact," but we bend none the less eagerly at the shrine of fancy. There is a world of images to be reveled in, as well as a world of propositions to be accepted. An element of make-believe is the spice of life; it is also the leaven of thought. As our reading must be largely made up of things that never happened, so our daydreams must be peopled with beings who never existed. If Nature is to be enjoyed, the mere knowledge attitude does not content us; if life is to succeed and not to languish, we must project values into it which the reals themselves, as intellectually apprehended, do not contain. We are indeed what we are plus Nature, but Nature is none the less what it is plus ourselves. Always our sense of objects needs reinforcing with a human element, be it only the "distant dearness in the hill," the "secret sweetness in the stream"; ever must our realization of events be suffused with personal values subtly distilled from the special characters of human condition and from the whole past of individual experience. From the simple line and curve of the geometrician to the most complex state of consciousness there is nothing that we do not idealize. Nor will feeling abdicate its rights: we emotionalize as well as intellectualize the raw material of knowledge. For the great problems of conduct, in the great crises of life, our actions acknowledge the sway of something more persuasive than logic and mightier than reason. And when the intellectual attitude fails, the religious attitude, with its grip on driving power, comes up in its place to seize the whole nature and bear it resistlessly along. Out of the despair of the slave, up from the agonies of the oppressed, wherever freedom faints or labor is shackled, wherever suffering overwhelms or bread is eaten with tears, wherever ignorance shrinks in fear, social injustice paralyzes, or dejection waits on individual shortcoming, the image of a divine helper and judge, dispensing the compassion that belongs to wisdom and the mercy which is an integral part of justice, shapes itself anew in the mind of man. Often the soul which needs a supreme passion, yet relies on knowledge for its deliverance, traverses the experiences of Lermontov's becalmed ship, its prow tending nowhither, its white sails fluttering idly betwixt earth and sky. Golden sunbeams play upon it; dancing wavelets invite it to action. They are powerless to break the spell of indecision that holds it in thrall. A single longing goes out to the elements from swaying hull and quivering masts: "Oh for a tempest, for only a tempest can bring peace!"

Now the antithesis here disclosed, indissoluble as it may seem, is of form rather than of substance — superficial rather than fundamental. It is impossible that an attitude which favors self-maintenance should be totally opposed to another attitude which is also in its way life-favoring. As emotional against intellectual, the two fly apart; as intellectual they coalesce into stereoscopic solidity. We are here, in fact, dealing with a loose construction of reality set over against a stricter construction of it, and therefore, in the light of that contrast, with an artistic, poetic and religious view which has always adumbrated the salient truths of the scientific view. This process of pre-figuring with the grosser symbols of feeling the more exact symbols of knowledge which are to succeed them is manifest all through the history of human thought. Many will symbols are nascent intellectual symbols, as many intellectual symbols are perfected feeling symbols: the symbolism is progressive from crude to refined, from loose to exact, in both fields. Even when the later theories are not adumbrated by the earlier theories, deep and subtle analogies connect all views of Nature, and this for the reason that it is the same cosmos and fundamentally the same human mind which gives them rise. A provisional value for practical life may be found in hypotheses the most erroneous; a view that comes forth from the mold of feeling may long dispense with the more correct view which has the intellect for its sponsor. Men could adjust themselves successfully to the laws of gravitation even when gravitation was believed to be a purely local process determined by a quality called weight. The savage familiar with the daily rise and set of sun is well enough served without needing to know whether it is the motion of the earth or that of the solar body which brings the dark and the dawn. The utility of the Pleiades as sailing stars was at least as great under the Ptolemaic as under the Copernican system. Even in our time living is not demonstrably interfered with by such beliefs as that color inheres in objects and that electricity is a fluid.

Advance in the scientific study of Nature is frequently a progress from the image symbol to the proposition symbol, each earlier stage of it useful, if less useful than the later stages. Originally the atoms loved or hated each other, were sharp, round, smooth, or clung together by means of hooks; the modern theories brought chemical affinity, attraction and repulsion. It is a far cry from Democritus to Dalton, yet the atomic theory bridged the distance between them. The Greek explanation of vision as due to images emitted by objects anticipated the Newtonian hypothesis of moving material particles; both pre-figured the modern account of light as a propagated wave disturbance in ether. As Kepler's whirling fluid symbolically anticipated the reference of the planetary motions to gravitation, so Le Sage's hypothesis of flying corpuscles pre-figured the later explanation of gravity as a result of differential stress by the ether system. The advance from the conception of heat as a substance to that of heat as a mode of motion has its parallel in another field of science; for while Descartes (" Passions de l'Âme," Article 7) regarded the nerves as little threads or tubes which all come from the brain, and like it contain a subtle air or wind, termed the "animal spirits," the physiologists of a later epoch spoke of a " nervous fluid," and finally taught that impulses from the brain are transmitted as molecular motions of the nerve substance. As chemistry was implicit in alchemy, so is the dynamic explanation of life implicit in vitalism; as Darwin's pangenesis anticipated the more detailed and concrete formula of Weismann, so the germplasm hypothesis may be no more than an adumbration of the theory of heredity which is to supplant all its predecessors.

Not only are strictly scientific views thus connected among themselves: thus connected also are the interpretations we call metaphysical, philosophical, religious. Through all accounts of Nature runs the uniting thread of analogy. From mechanics to teleology and from anthropomorphism to naturalism the causal explanation is common to all attitudes. Religion has its overshadowing infinite, and science its " What is man that Thou art mindful of him, and the son of man that Thou visitest him? " The very development of the two interpretations takes in each the same course. Worship, associated in the beginning with separate objects passes by coalescence of these into worship of groups of objects, and finally into worship of a single object. So science, which first conceives of objects and forces as independent of each other, progresses to recognition of them as interconnected, and finally to the thought of a single object or power, the all-embodying universe. And the purification of science from the grosser metaphysical elements of knowledge has its analogue in the progressive elimination from monotheism of the grosser anthropomorphic elements.

By no means does surrender of the conception of a personally directed cosmos require us wholly to part company with what is deepest in the religious attitude. For religion springs neither from awe nor from wonder, however intimately it may be bound up with these. It arises not in the feeling of an unattainable infinite, whether of time or of space, nor yet in the sense of an unknowable absolute. Like science, it is born out of the demand for cause — has its origin in man's recognition, intellectual as well as emotional, of his unescapable subordination to and dependence upon a supreme power to which, alike in conduct and knowledge, he must adapt himself, immediately through the natural environment, mediately through the society to which he belongs. We have seen that the knowing faculty admits us to only a part, infinitesimally small, of the totality which we call universe. From the cosmos we receive our definite character as organisms only along a single line, and are irresistibly led to look beyond the ray of our own particular inheritance to the possibility of altogether different yet equally definite emanations from the same infinite richness which has provided us with the only modes of existence we can ever hope to comprehend. As there are doubtless somewhere within the scope of human knowledge, without being yet accessible to it, organisms more perfect, of wider powers, of more developed intelligence than ours, so doubtless beyond that scope there are countless over-reals which neither the reason nor the creative imagination will ever enable us to reach. But religion, while dimly envisaging the supernature, is not content with the Psalmist's " Canst thou by searching find out God? " Springing from the needs which link man with the lowest forms of life, it calls not only for an object of reference, but also for an object which it can comprehend. In weaving a religious form for that object, it really postulates the power which is the object of the scientific conception. And though it be far easier to think psychomorphically of the Almighty than to submit cosmic omnipotence to the conditions which the reason imposes, it is surely far grander to choose of two views the one which, based not on a few but on all the relations necessary to a judgment, asserts itself so manifestly as fundamental. The worthy intellectual satisfactions of such a choice are also forthcoming. If we are obliged to relinquish the thought of a being limited by will, consciousness and knowledge, subject to personal appeal, swayed this way or that by emotions, thoughts, interests, we gain as compensation the conception of an ultimate cause, — potential of these as their source and support, — which has originated, maintained, destroyed, has given and has taken away, since the beginning of material things. Our human trust in this power acquires a sublimer meaning when it is divested of the capricious possibilities of voluntary action; the uniformities of Nature gain new certainty from the thought that they are super-personally, not personally sustained. Best of all, reaching out to that deeper bond which beckons to us from beneath the show of things, we are enabled to found our relations with almighty power and with the whole nature world on the enduring basis of the conviction that the cosmos is really and not fictitiously like unto ourselves.

The ethical attitude is also rationalized by delivery of it from the narrowing interpretations of the subjective view. The cosmic sanctions and prohibitions will continue to overarch the realm of human conduct, as the heavens will continue to overarch the earth. Yet the immediate source of ethics must none the less be sought in man himself. The demand for ethical conduct, however simple or complex the conditions may be, is the demand that the human individual shall adapt himself to the human system. This adaptation begins in the "must" of compulsion; it reaches its highest development in the "ought" of voluntary choice. With qualifications that need not be discussed, moral conduct in the individual is conduct which is beneficial to the community, or at any rate in harmony with its requirements; immoral or unmoral conduct is conduct which is in conflict with, and therefore injurious to, group, national, or race interests. The whole problem of conduct is thus bound up with the progressive movement of human society towards unification, and therefore with the destinies of the race as a whole. And this movement — itself the outcome of the inevitable procession from conditions of differential towards conditions of equalized stress — has for its unconscious inducement that increase in the scope, the economy, the efficiency and the total yield of social maintenance which must result from the inclusion of all human individuals, to whatever race, political division, or geographical habitat they may belong, in a single coöperating system. The real meaning of caravan route, highway, canal, railroad and ocean steamer; of telegraph, telephone, submarine cable and radio; of travel, trade, colonization; of foreign diplomacy, international congresses, tribunals of peace and schemes for a "universal language;" is that the world needs all its available populations for tasks of world coöperation in the interests of world maintenance. Assuming that the goal so plainly in sight is to be reached; assuming that the time interval open to men on this planet is not too great for its realization; assuming also that there will be no catastrophic interference with the process — then the course of human evolution may be suggested, at least in outline. The process of extension, assimilation, inclusion and elimination, committed no longer to a single group, but to a plurality of groups, will go on until through perfected relations there is complete recognition of the supremacy of human interests over narrowly national and individual interests — until, through unification, the effort of all shall be devoted to the welfare of each, and the labor of each consecrated to the well-being of all. In the involved harmonization of group conduct with world conduct the antagonisms of war will give place to the milder rivalries of peace; the power now wasted in endlessly repeated institutional and administrative forms, in endlessly multiplied agencies, communal, national, international, will be saved by the setting up of more economical organs of the local and general life; and while ample scope will remain for those types of ethnic and racial character which heredity, habitat and experience have specialized, all such types will be rigorously held to their contribution for the general good. The self-sense, the nation sense, the race sense, permitting at once the differences needed for competition and the antagonisms essential to coöperation, will remain as conditions of human progress. But it is the world sense which, supplementing and dominating, is to preside over the unifying process until the total resources of humanity, accumulated and organized, find their fullest exercise in enlarged tasks and perfected methods of maintenance, with a result in the total yield of human effort, and in the multiplication of the powers and opportunities of each individual, whereof only a faint conception can now be formed.

Earlier in this survey we have seen that the hope of a rational interpretation of Nature which shall include both science and religion, without straining the one or flouting the other, rests on the ability of the mind to save reality, by expansion of it, from being singularized, and to rescue life, by delimitation of it, from being universalized. As we now envisage them, the two attitudes are no longer set off from each other by an impassable gulf. In the one view we get a loose symbolism reinforced by feeling, in the other view a closer symbolism reinforced by the intellect. Both are aids to life, and both mean fundamentally the same things. They differ only in form. For the artistic, the poetic, the religious outlook, the universe reveals the superficial characters of intelligence — consciousness, mind, personality; for reason in its highest reaches the cosmos displays the fundamental characters of intelligence — modes of a power unfathomably rich, chance under the rule of direction, change which has its term in endurance, the strivings of a universe which works unceasingly towards ends. Through the philosophical illumination of the one, through the philosophical enlargement and enriching of the other, faith and reason thus enter into the possession of verities common to both. The knowledge of why they are differentiated should bring into greater prominence the characters in which they agree; the knowledge of why they agree should diminish emphasis on the characters in which they differ. With this advance achieved, the crudities and contradictions of religious thought would no longer promote the drift of our modern age toward mechanicalized conceptions of Nature. Reverence would become a normal attitude of the human mind, not an exceptional exercise of its functions, and atheism not an ever-recurring delusion, but an impossibility. And as science would cease to be disparaged because of its machine-like universe, so religion would find itself relieved from the reproach of an outlook based exclusively on the analogies supplied by life and by man.

Meanwhile sympathy with the scientific attitude should help potently to unify the religious outlook, still broken up by differences of race and denomination, just as sympathy with the religious point of view should aid science in realizing the limitations of knowledge and the impossibility of regarding it as a universal solvent. Hitherto, by taking the organism and its life powers for granted, science has failed to recognize the inherent purposiveness of the cosmic process; and religion, by clinging to psychomorphic, sometimes to anthropomorphic views of "design in Nature," still gives us what science can regard only as a magnified form of the ways in which, with the aid of perceptions and mental activities, man works his will on the objects around him. In the view offered here the possibility of reconciliation is held out between the attitude which ignores the cosmic trend and that which is content to humanize it. For whatever may be thought of its origin — and a mystery looms there which should warn off dogmatism on both sides — cosmic purposiveness furnishes a link between science and religion the recognition of which, though they may continue to differ in unessentials, should furnish them with new grounds for that agreement on essentials which was never more needed for the promotion of human welfare than it is to-day. Thus far the procession of human thought through the ages has resembled the advance of a great host whose unequal divisions, starting from guide-posts that stand apart, have been content to travel by different roads. They are now more than ever within hailing distance; at many points they already touch and fraternize. And with growing recognition of the truth that, different as their directions may seem, science and religion are aspiring towards the same goal, the time should not be far distant for a closer union of minds and hearts than any of which man has yet dreamed.

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